

Effects of Students' Enrolment on Unit Cost of Education

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Abstract: The study was guided by the following objective. Determining how the unit cost of providing secondary education is affected by students' enrolment. The study used descriptive research design and the instruments used for data collection were two types of questionnaires. Data was collected from 14 secondary schools, which were sampled using stratified random sampling; data was analyzed using descriptive statistics. Major findings of the study were as follows. Enrolment below and above the optimum was found to increase the cost per student (unit cost) while optimum enrolment resulted in decreased unit cost. An optimum enrolment of 450 students with unit cost of Kshs. 23,352 (US\$ 335) for boarding schools and an optimum enrolment of 257 students with a unit cost of Kshs. 12,253 (US\$ 175) for day schools was found. The findings of this research will be of importance to the society in that educational institutions will aim at increasing their enrolment up to the optimum point and hence ensuring the minimum unit cost in the operation of the institutions.

Key words: Questionnaires, statistics, enrolment, educational institutions

INTRODUCTION

This part deals with unit cost in various educational institutions. Unit cost is a very important indicator of internal efficiency in educational institutions. Unit cost tends to decline as enrolment increases and the system is said to attain internal efficiency and the unit cost tends to rise when enrolment is falling. Various studies have been carried out on the unit cost and how it is affected by the students' enrolment.

Wolff in a World Bank study titled "Controlling the Unit Cost of Education in Eastern Africa" noted that as enrolment increased, unit cost went down since the recurrent expenditures were reduced and the teacher's supply increased. For instance, Tanzania, Rwanda and Burundi all of which were found to have high unit costs had also the lowest secondary school enrolment ratios (3 to 4%). The implication was that resources in these countries were under-utilized, while Mauritius with low unit costs had the highest enrolment ratio of 49%. He further noted that the major elements affecting unit costs were teachers' salaries, student-teacher ratio and non-teacher costs especially boarding costs. Non-teacher salary costs comprised on average 35% of the overall secondary education cost compared to only 10% of primary education by that time.

On the issue of student teacher ratio, Wolff further argued that it is an essential element in lowering the unit cost of education and hence improving the quality of education. He found that various countries had different ratios, for instance, Ethiopia had (41:1), Kenya (28:1), Zaire (27:1), Rwanda (13:1), Sudan (16:1), Burundi (17:1), Botswana (18:1) and Swaziland (18:1). He therefore concluded that there was need for increased contact between a teacher and students and therefore teachers will have enough time to check homework and class work, UNICEF^[1]. Therefore there is need to increase enrolment in secondary schools.

Another study carried out by Durstine and Hudson^[2] in Barbados was aimed at lowering the unit cost of education. It focused on the case of team teaching, whether it would lower the unit costs of the school. In their study, they applied the economic principal of diminishing average cost. They observed that with a small number of students in the school, the cost was high. For instance with enrolment of 3 950 students in the education system, the unit cost was US\$21.15 and when enrolment was increased to 16 500, the unit cost fell to US\$ 9.20.

Still on unit cost, Rogers and Ruchlin^[3] argued that the efficiency of schools and school systems could be improved through economy of size. Actually an economy of size is a decrease in the average cost of producing an

item related to an increase in the production of that item. Economies of size often result from indivisibilities, implying that a necessary item may come in a minimum size. For example, one cannot have a half cinema projector. However, as enrolment increases, one does not necessarily need to increase the number of cinema projectors in order to provide the new students with films. Therefore, the average cost of providing films per student decreases as the number of students' increases and this is an economy of size situation. Still, it is possible for diseconomies of size to exist. A study carried out by Gitau^[4] found that, as the size of an educational system increases, a point may be reached where it is necessary to add administrators at a more proportional rate, due to the system becoming more and more complex and difficult to co-ordinate. This would cause the average cost per student to increase. Therefore, an education system should have that optimum size, this is the one that captures all economies of size and does not yet reach the diseconomies of size stage. The implication here is that the enrolment in schools should be up to the optimum level.

Another study by the World Bank^[5] on Senegal's education system observed that teacher's salary accounted for the increased unit costs. The study pointed out that one way of lowering the unit costs in Senegal was increasing enrolment and therefore reducing the amount of over-crowding in urban primary schools. This was through introduction of a system of double shift. The argument here was that should double shift system succeed in Senegal, then the number of student places would increase by approximately 33 000 by the year 2000. However, the study is silent on the reduction of unit costs in the secondary schools system through the use of double shift.

Another study still by the World Bank^[6] has pointed out the reasons for coming up with double shift schools as follows; increased efficiency of use of human and capital resources (i.e., teachers can teach more pupils/ students and there is reduced need to build more schools), increased access through increased number of school places, increased teachers' salaries without increasing unit costs, i.e. if salaries are low and teachers are paid only a little more for teaching two shifts, pupils/students can perform productive work during the day (because they attend school only in the morning, afternoon or at night), thus reducing the opportunity costs of attending school, reducing over-crowding when enrolment rates are high. The Republic of Kenya^[7], has also agreed with the same argument on double shift schools. Here, it is argued

that double shift use of classrooms in overcrowded schools can save substantial construction costs and also improve the internal efficiency of schools through maximum utilization of the classrooms. Therefore double shift schools are often seen as a temporary measure where financial resources (of the government and/or parents) are constrained, hence double shift schools should be introduced fully in the country.

Unit cost can also be reduced by using the available resources more intensively for instance using the classes during the evening times and during the vacations. A good example of this is Makerere University, in the sense that the university has made some impressive improvement in the internal efficiency, primarily through administrative decentralization and more intensive utilization of space. Of particular importance here, is the use of university facilities for evening classes, which is when most of the private students are taught for their degrees, Court^[8]. The same is also witnessed in the universities in the country where-by there are various modes of learning such as the regular programs, part-time, school based and even open learning among others.

Hence, the objective of the study was to determine how the unit cost of providing secondary/high school education is affected by students' enrolment.

MATERIALS AND METHODS

This part describes the research method that was used in the study. It details out the research design, study area, data collection methods and instruments used.

Research design: The descriptive research design was used in this study. This method was appropriate as it involved collecting data in order to answer questions concerning the status of the subject. More still, descriptive studies are concerned with gathering facts rather than manipulation of variables Koul. Therefore, the descriptive design was appropriate as a means of achieving the objectives of the study, on the analysis of the internal efficiency of secondary schools in Murang'a District.

Study area: The study was conducted in Murang'a District, Kenya in the year 2004. The District borders Nyeri in the North, Nyandarua in the West, Maragua in the South, Kirinyaga and Embu in the East. It is one of the Districts in Central province, Kenya. Murang'a District was chosen as a study area since the researchers were familiar with the place and its proximity.

Research instruments: Data for this research study were collected using questionnaires and reading of educational documents. Questionnaires were used because they were most convenient for this type of study. Two types of questionnaires were prepared, one for the principals and the other for the teachers in the sampled schools for the purpose of data collection. The two types of questionnaires were based on the research questions as formulated from the research problem.

Data collection/procedure: Upon receiving research authorization from the Ministry of Education, the researchers made familiarization visits to the sampled schools before data collection. They visited each of these schools to present the teachers and the principals with the respective questionnaires. Five questionnaires were taken to each of the sampled school. One questionnaire was for the school principal and the other four for the teachers in the same school. Once the questionnaires were filled, the researchers made arrangements to collect them. They encountered several problems while collecting the data; firstly, some school principals were not free in giving information on matters relating to finance, secondly, some respondents took much longer time in filling the questionnaires and therefore delaying data processing.

Data analysis: All completed research instruments were assembled and information organized. This involved the analysis of the principals' and teachers' questionnaires from the fourteen sampled schools having seventy respondents that is fourteen principals and 56 teachers. The researchers prepared a data analysis plan on which it was possible to record responses to items from each respondent. The analysis plan held information on: Items, responses/ frequencies and percentage of different responses from the respondents.

The data was analyzed using descriptive statistics. This involved the use of frequency distribution tables and percentages. Graphical representation of data was also made. Tables and percentages were mostly used because they were easy to read and interpret. After the analysis of the data, discussions and deductions were drawn.

RESULTS AND DISCUSSION

The data collected from the sampled population were analyzed and presented in the form of frequency tables and scatter graphs. They were analyzed in line with the objective.

Determining how the unit cost of providing secondary education is affected by the students' enrolment: Table 1

shows the respondents views on that, as enrolment of students increases up to the optimum, unit cost decreases and vice versa. Five-point scale type of response is used.

As shown in Table 1, 33.9% of the respondents strongly agreed that enrolment of students increases up to the optimum point. Unit cost of providing goods and services decreases. Similarly, 46.5% of the respondents agreed that as enrolment of students' increases up to the optimum point, unit cost of providing goods and services in schools decreases. Five respondents were uncertain as to whether unit cost of providing goods and services decreases as enrolment of students' increases. 10.7% of the total respondents disagreed on that unit cost of providing goods and services in schools decreases as enrolment of students' increases. Therefore 80.4% of the teachers were in agreement that as enrolment of the students increases up to the optimum point, unit cost of providing goods and services in schools decreases and vice versa. This is true because as enrolment of students increases, it is easy to spread the cost over the large number of students and therefore lowering the cost per student (unit cost). Table 2 shows the respondents views on the question that enrolment below and above an established optimum increases unit cost. Five types of responses are given.

Table 1: As enrolment of students increases up to the optimum point, unit cost of providing goods and services in schools decreases and vice versa.

Responses	Frequency	Percentage
Strongly agree	19	33.9
Agree	26	46.5
Uncertain	5	8.9
Disagree	6	10.7
Strongly disagree	0	0
Total	56	100

Table 2: Enrolment below and above an established optimum tends to increase unit cost in schools.

Responses	Frequency	Percentage
Strongly agree	13	23.3
Agree	26	46.5
Uncertain	8	14.3
Disagree	4	7.1
Strongly disagree	5	8.1
Total	56	100

Table 3: The effects of students' enrolment on the unit cost of providing goods and services in secondary schools.

Responses	Frequency	Percentage
As enrolment increases up to a certain point, unit cost of providing goods and services goes down.	8	53.3
When the school enrolment is low, then the financial obligations are rarely met since the unit cost is high	7	46.7
Total	15	100

From Table 2, 23.3% of the respondent, strongly agreed that enrolment below and above an established optimum tend to increase unit cost. Similarly 46.5% of the respondents agreed that enrolment below and above an established optimum tend to increase unit cost in schools.

Eight teachers (14.3%) were uncertain as to whether enrolments below and above an established optimum tend to increase unit cost. On the other hand, 7.1% of the respondent disagreed on that enrolment below and above an established optimum tend to increase unit cost. Similarly, 8.1% of the total respondents strongly disagree on that enrolment below and above an established optimum tend to increase unit cost in schools. In the strength of this, the teachers and the principals were in agreement that as enrolment of the students is increased, up to the optimum, the unit cost goes down and vice versa.

Determining how the unit cost of providing secondary education is affected by the students' enrolment: Table 3 shows the respondents views on the effects of students' enrolment on the unit cost. Unit cost varies according to the enrolment of students.

As shown in Table 3, 53.3% of the principals said that as enrolment increases, unit cost goes down. In addition, 46.7% of the principals said that when enrolment is low, then the financial obligation of a school are rarely met. The implication here is that in case of low enrolment the cost is spread out over few students and therefore cost per student is high while in case of enrolment above the optimum point, there may be other cost and therefore the unit cost moving up.

The next question sought to know from the principals whether unit cost has an influence on the quality of educational output of secondary schools. Thirteen principals representing 92.9% of the respondents said that unit cost have an influence on the quality of educational output of secondary schools, while one principal said that unit cost does not affect quality of educational output. Unit cost therefore influences the quality of educational output of secondary schools in the following ways: In case of enrolment below and above the optimum level, schools experiences high unit cost. High unit cost implies that schools cannot afford the necessary resources for learning such as textbooks, laboratory equipments and hence students' receiving low quality learning and the end result is low quality educational output. On the other hand optimum enrolment implies that schools are experiencing low unit cost. In case of low unit cost, schools are able to purchase educational resources such as textbooks among others and hence teachers giving students quality teaching. Also since low unit cost

Table 4: Enrolment and unit cost for boarding schools.

Schools	Enrolment	Unit Cost (Kshs.)
Wahundura boys sec. school	243	32905.5
Kiria-ini Girls sec. school	538	25781.2
Kiru mixed sec. school	320	27266.8
Kangema boys sec. school	475	21839.8
Kiambu mixed sec. school	303	28771.5
Kirogo boys sec. school	256	30408.8
Kianderi girls sec. school	321	28339.0
Gitweku girls sec. school	309	25826.20

Table 5: Enrolment and unit cost for day schools

Schools	Enrolment	Unit Cost (Kshs.)
Kamacharia sec. school	295	10371.0
Gitongu sec. school	235	12878.8
Muguru mixed sec. school	335	17823.8
Mugeka sec. school	188	16952.7
Kahuhia mixed sec. school	136	20351.1
Gaitheri sec. school	156	19683.2

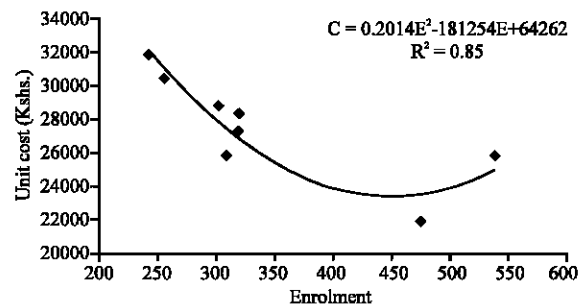


Fig. 1: Relationship between Enrolment and Unit Cost for Boarding Schools.

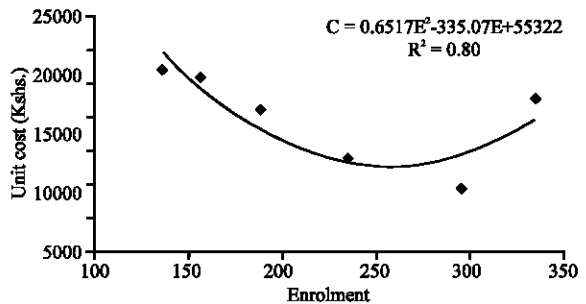


Fig. 2: Relationship between Enrolment and Unit Cost for Day Schools.

implies a situation of optimum enrolment, there is maximum teacher individual attention of students and hence promoting quality learning. Table 4 shows enrolment and unit cost data for boarding secondary schools. This information is used to plot the graph shown in Fig. 1, indicating the relationship between enrolment and unit cost for boarding schools.

The curve is denoted by the given quadratic equation as shown in Fig. 1, where C is the unit cost and E is enrolment.

Table 5 shows enrolment and unit cost data for day secondary schools. This information is used to plot the graph shown in Fig. 2, indicating the relationship between enrolment and unit cost for day schools.

The curve is denoted by the given quadratic equation as shown in Fig. 2, where C is the unit cost and E is the enrolment

Graphical representation was also used to show how the unit cost of providing goods and services in schools is determined by the students' enrolment. Unit cost was obtained by dividing the recurrent expenditure by the total enrolment for each school. The unit cost was then categorized in terms of the boarding and day schools to show the relationship between enrolment and unit cost in the two categories of schools.

This relationship of enrolment versus unit cost was then presented in the form of a scatter graph as shown in Fig. 1 using Table 4 for boarding schools and in Fig. 2 using Table 5 for day schools. The curve in each case denoted by the given quadratic equation shows the relationship between enrolment and unit cost. It shows clearly how the unit cost of providing secondary education is affected by the students enrolment. The curve also indicates that enrolment below and above an established optimum tends to increase unit cost in schools.

In Fig. 1, the optimum enrolment is given by 450 students; this is indicated by the lowest point on the curve. At the optimum enrolment, this reflects a three-streamed boarding school with 450 students and unit cost of Kshs. 23,352. The correlation of determination ($R^2 = 0.85$) show that there is a strong relationship between enrolment and unit cost in these schools. From the sampled schools used, it is clearly seen that the lowest unit cost is found at 450 students. Therefore, boarding schools in the District should enroll optimally so as to lower unit costs.

In Fig. 2, the optimum enrolment is 257 students; this is indicated by the lowest point on the curve. At the optimum enrolment, this reflects 257 students double-stream and unit cost of Kshs. 12,253. The correlation of determination ($R^2 = 0.80$) shows that there is a strong relationship between enrolment and unit cost in these schools. Day schools should also strive to enroll students up to the optimum level and hence lowering the unit cost.

This study conforms other research studies previously carried out, for instance a study by Dustine and Hudson^[2] aimed at lowering the unit cost of education. They noted that with small number of students in the school and the cost was high. They therefore argued that enrolment of students should be increased up

to the optimum level and hence lowering the unit cost. This will then make the schools to be more internally efficient. This research study also agrees with a study carried out by the World Bank^[5] on Senegal's education system. The study pointed out that one way of lowering the unit cost was through increasing enrolment in schools and therefore making the schools efficient.

In this research study, Fig. 1 and 2 shows that in majority of the sampled schools, as enrolment increases, unit cost goes down up to the optimum enrolment. Increasing enrolment of students make schools to operate at lower cost and hence making them to be cost effective in their operations and therefore realizing internal efficiency in their objectives, for instance a school may enjoy economy of size as a result of increased enrolment of students. Therefore, schools in this district should aim at increasing enrolment and hence lowering the unit cost in their operations.

Therefore, in Murang'a District there are schools, with enrolment below the optimum level and hence experiencing high unit cost and schools with enrolment above the optimum level and hence having high unit cost. Still there are few schools with optimum enrolment and hence experiencing low unit cost in their operations.

In addition, in a situation of optimum enrolment and low unit cost, schools are able to purchase educational resources in large numbers (in bulk) and hence enjoying economies of scale. This will therefore make schools have the necessary educational resources in abundant and this will go a long way in promoting learning and the end result will be improvement in the quality of high school graduate produced. In case of low unit cost as a result of optimum enrolment, schools will also benefit from economy of size. This implies that it is cost effective to provide educational resources such as academic films to a large number of students than to few students; therefore this also goes along way in promoting quality education.

CONCLUSION

The conclusion is based on the unit cost in education. It was found that the unit cost of education is affected by the enrolment of students. That is enrolment below or above the optimum tends to increase the cost per student, while optimum enrolment results to decrease in unit cost. Many schools sampled were found to have high unit cost as result of enrolment below or above the optimum. Unit cost therefore is a major factor affecting internal efficiency of secondary schools in Murang'a District as well as in the whole country. From the research finding, an optimum enrolment of 450 students was

arrived at with unit cost of Kshs. 23 352 for boarding schools. This implies that for schools to operate efficiently they should have enrolment of 450 students which is a three streams school. On the other hand, day schools were found to have optimum enrolment of 257 students with unit cost of Kshs.12, 253, which is double streams school. Therefore, schools should enroll students up to the optimum level in order to reduce the unit cost in their operation and therefore enhancing internal efficiency and quality education. It was established that; to lower the unit cost in secondary schools in the district, each school should aim at increasing enrolment of students up to the optimum level and therefore cost per student going down. Therefore, intensive use of the educational resources should be done efficiently in schools and therefore lowering the costs.

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