Determinants of Secondary School Performance in Mauritius

A Cross-Sectional Approach

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Abstract— **This paper studies the determinants of secondary schools' performance at School Certificate level in Mauritius for the 2014-2015 cohort. The state has been investing massively in education in a view of enhancing economic and social development. Using a cross-sectional regression model for 146 schools, various variables are employed to investigate their impacts on performance. Factors such as population, gender, types of school, specialist room and sport facilities and geographical location are found to have a statistically significant impact. Area of school premises, number of optional subjects and educational zones. On the other hand, do not have an impact. Recommendations on future areas of improvement of school performance and policy implications are here down addressed.**

Keywords- Academic performances; cross-sectional data; secondary school

I. INTRODUCTION

The education system in Mauritius, patterned after the British model, has improved greatly since independence. It has been free through the secondary level since 1976 and through the postsecondary level since 1988. Before 2001, children were admitted to secondary schools or colleges solely on the basis of national ranking which created an enormous disparity among the different colleges of the island. Later, the Minister of Education, Mr. Obeegadoo, decided to abolish this system. Instead, a grading system was introduced [1] on 2001. In 2009, the next government in power had set up other goals and the Strategic Goals of Primary Education during the period 2008-2020 have been spelt out as follows, improve equity of access to education, provision of quality education to all, achieve gender equality, improve efficiency of the school system. In 2015, the actual government concreted the move to nine-year schooling although it was proposed by the previous Ministry of Education, Culture and Human Resources, Mr. Bunwaree. The nine-year schooling [2] under the Ministry of Education and Human Resources, Tertiary Education and Scientific Research, headed by Mrs. Dookun-Luchoomun, has new objectives as shown by Table I.

The total government expenditure [3] for the first six months January-June 2015 and the financial year 2015/2016

are as follows: (i) January to June 2015: Rs 58,480 million, of which, Rs 7,867 million (13.5%) has been allocated to education and training and (ii) July 2015 to June 2016: Rs 120,645 million, of which, Rs 16,003 million (13.3%) has been allocated to education and training. The total budget on education and training has been allocated as follows: (i) January to June 2015: 52% to secondary education, 23% to primary education, 9% to tertiary education, 3% to technical and vocational education, 2% to pre-primary education and the remaining 11% to other expenses and (ii) July 2015 to June 2016: 51% to secondary education, 25% to primary education, 8% to tertiary education, 3% to technical and vocational education, 2% to pre-primary education and the remaining 11% to other expenses [3]. Free education is often compared to our local natural resource and the government expenditure on education as a % of GDP [4] was 4.96 in 2015 and the objective is shifting from quality education to the promotion of a holistic development of all students and providing equitable learning for all opportunities to attain high levels of achievement with the nine-year schooling system.

This study aims to fill the gap by investigating the causal nexus between the determinants and performances in the different types of secondary schools and tries to explore further the causes for the type of linkage with the help of fitting a regression model using STATA 14.0 software. This study proceeds upon and extends to the nine year schooling system as the facilities provided are still the same in all secondary schools.

TABLE I. NINE YEAR SCHOOLING OBJECTIVES

Equip all students with knowledge, foundational skills and attitudes leading to an empowered 2030 citizenry.
Inculcate in all students a sense of moral responsibility, a set of values and a strong identity for the country.
Promote the holistic development of all students.
Provide equitable Learning for All opportunities to attain high levels of achievement.
Achieve a smooth transition to and completion of secondary education.
Give greater recognition to the value of Technical and Vocational Education and Training (TVET) in building human capital and for sustainable development.

II. LITERATURE REVIEW

The theoretical framework will be based on Walberg's (1981) theory [5] of educational productivity and the Draft's system theory (2008) [6]. According to Wang, , Haertel, & Walberg, (1990) [5] there are 11 most influential domains of variables, 8 involve social-emotional influences: classroom management, parental support, student-teacher interactions, social- behavioral attributes, motivational-effective attributes, the peer group, school culture, and classroom climate (Greenberg et al., 2003) [7]. Distant background influences (e.g., state, district, or school policies, organizational characteristics, curriculum, and instruction) are less influential. Reference [5] conclude that "*the direct intervention in the psychological determinants of learning promise the most effective avenues for reform*" (p. 210). According to Draft (2008), the basic systems theory [6] of organizations consists of five components: inputs, a transformation process, outputs, feedback, and the environment. A system functions by acquiring inputs from the external environment, transforming them in some way, and discharging outputs back to the environment. Students are admitted into secondary schools from the society and transformed as output back to the society. The empirical literature review revealed the following domains of interest as determinants of colleges' performance:

A. Population size, infrastructure and performances(area)

Historically, larger schools have been advertised as providing a more comprehensive curriculum than possible in smaller schools, while reducing per pupil operating costs (Conant, 1956)[8]. Raywid (1999) [9] has further point out that studies indicate smaller schools allow more opportunities for students to be involved in co-curricular activities, and offer more personalization and individual attention than larger schools. However, size-achievement relationship is not clear, though some research indicates smaller schools facilitate higher achievement. (Burke,1987). [10]

B. Gender and performances

The early British findings reported by Dale (1969) [11] which suggests that mixed schools were better placed to meet the social and educational needs of young people (Dale, 1974) [12]. The results of these studies have been inconsistent, with some providing support for the benefits of mixed schools (Marsh, 1989) [13], while others support single-sex education. (Astin, 1977) [14].

C. Types of secondary schools and performances

Advocacy for public-private-partnership in education depends on some crucial assumption that private education can be more efficient and cost-effective than publicly provided education without diluting the quality of education (Kingdon, 2008 [15]; Desai, S., Dube A., Vanneman, R., & Banerji, R. (2008 [16]; Kingdon, 2010)[17]. In a U.S study, Lubienski and Lubienski (2006) [18] compare academic achievement among charter, private and public schools. One of the major findings shows that private schools scored higher than charter and public schools. However, in the study conducted by Igbinedion and Epumepu (2011)[19], it is'' revealed the percentage performance trend of public schools were higher than those of the private both males and females.

D. Room facilities quality and performances

The better the performance of the students, the more effective the system is assumed to be (Philias & Wanjobi 2011) [20]. In another related study, Cynthia & Megan (2008) [21] confirmed a strong and positive relationship between quality of school facilities and student achievement in English and Mathematics. In many societies, social goals change with time. For instance America's priority on human rights and personal freedom in the 1960s has changed to a focus on success in the global economy in the 1990s (Mukhopadhyay, 2005) [22]. Britain's current education policy is on schools demonstrating what students "*know and can do*" rather than numinous goals (Holt, 2000) [23]. It is also more important that the teachers and learners are properly accommodated to facilitate the teaching and learning that go on there. This is the essence of the school plant and facilities (Alimi 2004) [24]. Therefore school facilities are the space interpretation and physical expression of the school curriculum.

E. Sports and performances

According to a Sibley and Etnier (2003) [25] physical activity may actually be related to improved cognitive performance and academic achievement and provides evidence for the argument that physical activity should be a part of the school day for both its physical health and cognitive benefits. For instance, another study by Carlson et al. (2008) [26] reported that there were positive social effects from being involved in physical education, but no evidence of any benefit to academic performance. As a consequence, they concluded that physical education was not a significant factor for parents in their choice of school.

F. Location and Performances

Owolabi (1990) [27] accentuates that our highly qualified teachers prefer to serve therein rather than the rural areas. Giving credence to the above, Ajayi (1988) [28] finds significant difference in academic performance of students in urban and rural areas of his study. He concludes that large schools in urban areas tend to perform better in examinations than small schools in rural areas.

G. Options Offered

"*Choice represents a return to some of our most basic notions about education. In particular, programs emphasizing choice reflect the simple truth that the keys to educational success are schools and teachers that teach, and parents who insist that their children learn. They must work in concert, respecting each other's particular concerns and needs, not second-guessing each other*." Choice in education is the wave of the future because it represents a return to some of our most

basic values. "*Choice in education is no mere abstraction. Like its economic cousin, free enterprise, and its political cousin, democracy, it affords hope and opportunity.*" *President Ronald Reagan]). [29]*

III. DATA AND METHODOLOGY

According to Ministry of Education and Human Resources, Tertiary Education and Scientific Research there are 183 colleges segmented into four regional zones. The Mauritius Examination Syndicate statistics have been used to source the real achievements in terms of credits obtained in particular types of secondary schools across Mauritius for the period 2015. Overall, the number of secondary schools selected boiled down to 146 and selection is made purely on the availability of data [30].

For visual inspections, violin plots are computed to visualize the distribution of the passing rate data and its probability density. Such chart is an amalgamation of the box plot and the density plot which is rotated and placed on each side, to display the distribution shape of the data. The box plot displays the center, spread, asymmetry, and outliers in data while the density traces show the distribution of the data, with the valleys, peaks, and bumps indicating the concentration of observations. Furthermore, cross sectional regression models which are a type of model in which the independent variables are linked with one specific point in time (2015) [31] are computed.

IV. RESULTS

To investigate the determinants of performance makes use of an econometric framework which can be algebraically specifies as follows:

$$Y_i = \beta'X_i + \varepsilon_i \qquad (1)$$

where *Y* is performance of students using percentage of passing rate (pass) at secondary School Certificate (S.C.) level in 2015. *X* represents a vector of explanatory variables such student population (pop), are of school premises in meter squares (aream2), gender, types of school, quality of specialist rooms or facilities which includes workshops, art rooms, science and computer laboratories, textile rooms and food studies rooms (fac), quality of sport facilities which include gymnasium, football field, basketball, volleyball and handball pitch (sports), number of optional subjects offered such as Arabic, Hindi, Modern Chinese, Marathi, Tamil, Telugu, Urdu and others (opt), regional zones as classified by the Ministry and geographical location. Also, ε represents the error term whilst *i* is used to index secondary schools. Table 1 reports the descriptive statistics of each variable applied in the study.

TABLE II.　　SUMMARY STATISTICS

Variable	Mean	Std. Dev.	Minimum	Maximum
pass	67.201	25.824	7.41	100
pop	737.562	309.235	179	2037
aream2	13756.750	13855.630	618	107805
girls	0.363	0.483	0	1
mixed	0.281	0.451	0	1
state	0.459	0.500	0	1
fac	17.808	4.798	5	27
sports	5.500	2.509	0	9
opt	3.459	2.048	0	7
zone1	0.315	0.466	0	1
zone3	0.226	0.420	0	1
zone4	0.199	0.400	0	1
urban	0.493	0.502	0	1

Note: The quality of facilities have been graded by the Ministry, We assign a value of 3, 2, and 1 for grades A, B and C. A value of 0 is given for a non-graded facility.
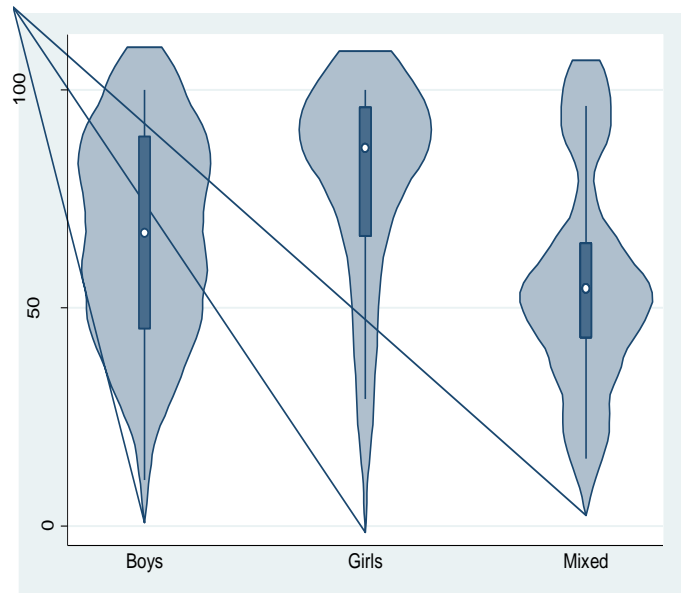

Figure 1(a): Violin Plot of Performance by Gender

As depicted in Figure 1(a), the performance distribution compared between boys, girls and mixed colleges is multimodal (more than one peak). For instance girls (60%) lower quartile pass performances are higher compared to boys(48%). Mixed colleges have a slightly these results are consistent with those who support single-sex education (Astin, 1977) [14]; Lee & Bryk, 1986[32]; Spinath et al. (2010) [33] highlighted the importance of personality and motivation for gender differences in school achievement. They find that a higher level of extraversion was associated with higher grades for girls but lower grades for boys.
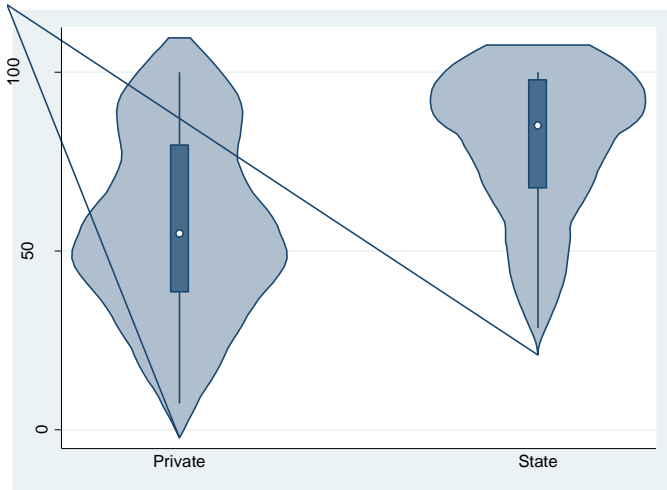
Figure 1(b): Violin Plot of Performance School Type

Referring to Figure 1(b), state secondary schools in general tends to perform better than private secondary schools and this is in line with the findings of Igbinedion and Epumepu (2011) [19] but inconsistent with a study carried out in the U.S. by Lubienski and Lubienski (2006) [18] where they compare academic achievement among charter, private and public schools. One of the major findings from this study shows that private schools scored higher than charter and public schools. In Mauritius the context is different as private aided schools tend to invest less in their infrastructures but improvements are being observed.
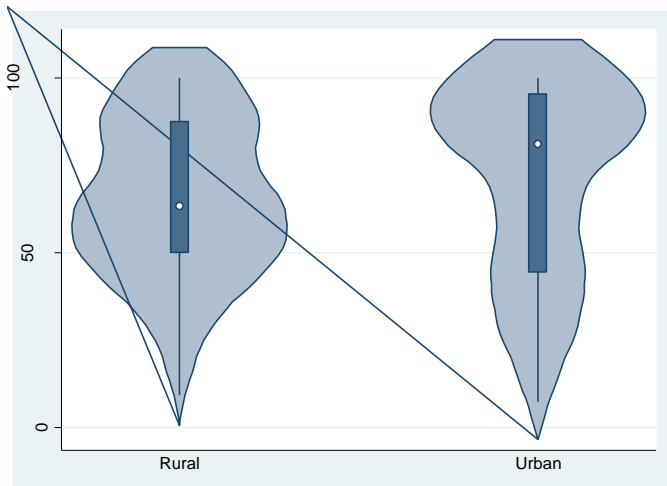

Figure 1(c): Violin Plot of Performance by Geographical Location

The mean value of urban colleges is about 49.3 % with a superior performance compared with rural colleges. As illustrated in Figure 1(c), the performance density is in the upper quartile region in contrast to rural areas showing a bulge in its lower quartiles. The mean of performances is above the median for both locations indicating that the college performances distribution is right skewed. A similar pattern of over dispersion is observed for the natural logs of the value of college performance measure used in the econometric model.

According to Kemjika (1989) [34], in his studies on urban and rural differences in general showed that location of the community in which the school is situated has effect on the performance of pupils. Ajayi (1988) [28] concluded that the achievement must have been borne out of many facilities they were used to which were not available in the rural set up. However, the zoning system in Mauritius is quite fair and the current study shows that performances are insignificant in terms of zones but serious in urban and rural areas.

TABLE III.   CROSS-SECTIONAL ESTIMATES

Variable	Model 1		Model 2	
	Coeff.	*Std. Error*	*Coeff.*	*Std. Error*
pop	0.035	0.006***	0.032	0.006***
aream2	0.0001	0.0001	0.0001	0.0001
gender (R: boys)				
girls	10.583	3.386***	10.942	3.322***
mixed	1.004	3.975	4.507	4.011
state (R: private)	12.806	5.387**	13.369	5.031***
fac	0.852	0.405*	0.941	0.392**
sports	0.825	0.671	1.150	0.678*
opt (R: unoffered)	0.578	1.248	1.193	1.191
regions (R: zone2)				
zone1	-4.704	3.995	-	-
zone3	-4.693	4.194	-	-
zone4	4.553	4.416	-	-
urban (R: rural)	-	-	9.384	3.065***
constant	9.265	6.995	-1.132	7.086
R^2	0.5923		0.6006	
Adj-R^2	0.5589		0.5741	
F-Test	17.70 [0.0000]***		22.11 [0.0000]***	
Root MSE	17.151		16.99	
Mean VIF	1.90		1.87	
White Test	81.96 [0.1032]		60.02 [0.1344]	
Norm. Test	968.529 [0.0000]***		678.428 [0.0000]***	
RESET Test	1.111 [0.3595]		0.705 [0.6459]	
Observations	146		146	

Note: ***, **, * denote 1%, 5% and 10% respectively. R: reference category. The standard error is in brackets. P-value is in square brackets.

Two distinct models are run. One including the educational zones and the second, including the geographical location. The Spearman's ρ correlation coefficients between urban and zone1, zone2, zone3 and zone4 are -0.1382 [0.0963]*, -0.0855 [0.3046], -0.0090 [0.9144] and 0.2644 [0.0013]*** respectively. These results reveal some evidence of correlation among the two categorical variables

Some preliminary tests are conducted before running the model. The mean variance inflation factor (VIF) statistics for the two models is computed to be around 1.90 which is less than 5. This reveals that multicollinearity is not a serious issue. The null of homoscedasticity cannot be rejected by the White heteroscedasticity tests. Doornik-Hansen test reveals that the null of normality of the residuals is clearly rejected at 1% level. Although the normality assumption does not hold, asymptotic results can still hold for a wider class of distributions Von Cramon-Taubadel (1998) [35]. The Debenedictis-Giles RESET tests reveal that the null of well specified model cannot be rejected. The R^2 shows that changes

in *Y* are related to about 60% in the explanatory variables. The F-test of the joint insignificance of the X's is strongly rejected.

Overall, school population, gender, type of school, specialist room facilities quality, sport facilities and geographical location of schools are found to have a statistically significant and expected impact on school performances at S.C level. These are discussed below. In line with point estimates, a one-percentage point increase in population performance by about 0.04 percentage points, ceteris paribus and this is in accordance with [8]. The mahatma Gandhi institute and Loreto Convent Quatre- Bornes have above 90% pass although with population size above 800.

A one-percentage point rise in girls schools relative to boys translates into a rise in performance 11 percentage points while relative to mixed schools, there is no difference. This may be partly due to our British-based education system explained by Ormerod (1975) [36] in a series of study backing single sexed, girls performances over boys, La Gaulette SSS is the only mixed state secondary school in Mauritius with only 50% pass on overall. A one-percentage point rise in state schools relative to private ones lead a rise in performance 13 percentage points while relative to mixed colleges. The lowest state secondary (St Aubin SSS) pass rate is 32.35% pass relative to last in private secondary school (0%).

A rise by one-percentage point in quality specialist room facility is also found to have a 0.9 percentage points increase in performance of secondary schools. Referring to Model 2, aome evidence is found whereby higher quality of sport facilities is found to increase performance of schools significantly. Per se, Loreto Convent Curepipe has only one specialist room facility, fashion textile room, better than Loreto Convent Mahebourg, its % pass is 87.73% relative to 81.3%. Higher quality of school facilities is found to increase performance of schools significantly as shown by Modern college (85.34%) compared to St Andrew's College (72.14%). Both are mixed private colleges from zone 2.

A rise by one-percentage point in schools in an urban region relative to rural one improves school performance by about 9 percentage points. Comparing two national colleges from zone 3 indicates a relatively higher % pass in forest Side Girls SSS, urban, in contrast to France Boyer de la Giroday SSS which is a rural based school. This is in favour of Owolabi (1990) [27] who accentuates that our highly qualified teachers prefer to serve therein rather than the rural areas.

On the contrary, size of premises, number of optional subjects and regional zones do not have an effect. Indeed, it can be argued that the schools pertaining to each educational zone have been meticulously selected to give all Mauritian students equal chances of securing a performance based secondary college based on their performances at grade 6 levels. For instance, each zone has private and state secondary schools which offer almost the same facilities but the difference lies in between colleges.

V. CONCLUSION AND POLICY IMPLICATIONS

This study analyzes the factors influencing the performance of 146 schools are school certificate level over the 2015 period. Various factors such as school population, gender, type of school, specialist room facilities, sport facilities and geographical location of schools are found to have a statistically significant impact on performance. For instance, the Government is implementing the nine year basic education with the objectives to offer quality education and to reduce the rat race for star schools. Six non-core subjects including oral expression, information and communication technologies, physical education, arts, and road safety education are being offered up to grade 6. The rat race has been postponed to grade 9 which may bring some relief to all stakeholders. Besides, sport facilities may help students in their performances as it is significant too. However, as far as this research work is concerned options offered is insignificant relative to overall performances and our students are moving into secondary schools whereby most significant determinants remains untouched: population size, types of secondary schools, school specialist room facilities and school location. Besides, the national form III exams will bring further stress and academies will be operational in grade 10 and it will be mixed type and once more insignificant in our local context.

Secondary schools with high population are more performing in Mauritius compared to small colleges which is consistent with findings of Conant (1956) [8] and Cubberly (1922) [37] where larger schools have been advertised as providing a more comprehensive curriculum than possible in smaller schools, while reducing per pupil operating costs. In Mauritius, many small private schools are being close down by the Government due to education reforms. One possible solution is to group small colleges which are in the same region instead of closing down. This could eliminate the problem of redeployment of human resources and students.

It's an open secret in Mauritius that girls are higher achievers when compared to boys. There is only one mixed state secondary school in Mauritius (La Gaulette SSS, % pass: 28.57) with a very low outcome and this is in accordance with Spinath, Freudenthaler and Neubauer (2010) [33] highlights the importance of personality and motivation for gender differences in school achievement. They find that a higher level of extraversion was associated with higher grades for girls but lower grades for boys. Private colleges still offer the mixed services supported by the early British findings reported by Dale (1969; 1971; 1974)[11][12][39] which suggests that mixed schools are better placed to meet the social and educational needs of young people (Dale, 1974)[15]. However, the local context demands single sexed secondary schools but the issue is that the incoming academies will be mixed [2] and the policy makers should be cautious.

Significant results indicate a direct relationship between specialist room facilities and performances at SC level supported by Cynthia & Megan (2008) [9] who confirm a strong and positive relationship between quality of school facilities and student achievement in English and

Mathematics. In Mauritius, only a few colleges have all quality specialist room facilities. In many colleges, both private and state students have to compromise between Design & communication/Technology workshops against Fashion & Fabrics/food & nutrition study rooms as these subjects are gender biased (Port Louis North SSS Boys against Port Louis SSS Girls). The government needs to offer both facilities irrespective of gender thereby allowing more subject choices and better performances.

According to a research (Sibley & Etnier, 2003) [25] physical activity may actually be related to improved cognitive performance and academic achievement and provides evidence for the argument that physical activity should be a part of the school day for both its physical health and cognitive benefits but in Mauritius there is a miss match and in some colleges (France Boyer de la Giroday SSS, Swami Vivekananda SSS, Riviere des Anguilles FVI College: Girls colleges versus Emmanuel Anquetil, Hamilton college: Boys colleges). In some private colleges (unity college, 9.22% and Presidency college, 10.53%), sports facilities are not common and unsurprisingly they have very low performances. Thus, the government should come with corrective measure so that in future colleges are equipped with most up to date sports facilities and ensures maximum use of these facilities. For instance, students may be encouraged to make use of college sports facilities during the weekends by organizing sports competition which is difficult during working hours. This study is in favour of the nine-year schooling as it offers physical education.

In Mauritius, colleges from urban regions have better performances than rural colleges and this may be due to the various facilities associated with urban areas. Owolabi (1990) [28] accentuated that our highly qualified teachers prefer to serve therein rather than the rural areas. As a corollary of the above, Kuliman, Weather and Batterworth (1977) [39] observed that teachers do not accept postings to rural areas because their conditions are not up to the expected standard as their social life in the areas is virtually restricted as a result of inadequate amenities; facilities are deficient, playground are without equipment, libraries are without books while laboratories are glorified ones. Policy makers should ensure proper rotation of educators across the island in state colleges and this practice can be extrapolated to even private colleges as most educators are at least have a degree in specifics fields.

VI. LIMITATIONS AND FUTURE RESEARCH

Cross sectional data has been used and this can be extended using Panel data. College specialist room quality facilities specific to subjects like sciences, designs and food and nutrition can be related to subject wise performances to elaborate the individual impacts. The % of credits in core subjects like Mathematics, English language and French language should be used instead of overall % pass which includes both credits and passes in order to have a true picture of performances. HSC results can be used and correlated with SC results to confirm the results making the findings more robust. These results can used to shape the nine-year schooling

firstly by giving more student access to incoming academies as it has a positive impact on performances, mixed academies may be aborted for single sexed ones as it is more appropriate in the local context. Grants can be given to improve specialist room and sports facilities and lastly the government must ensure a fair rotation of its teaching and non teaching staff to all regions across Mauritius to ensure equity.

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