CONSTRAINTS ON THE EFFICIENCY: EVIDENCE FROM TECHNOLOGY STREAM STUDENTS IN ADVANCED LEVEL

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ABSTRACT

Improvements on Higher Education System are considered absolutely necessary in order to develop human capital of any country. However, Arts students, who offer technology as a subject which was newly introduced into the Advanced Level syllabus in Sri Lanka , are facing many constraints. A hundred students who sat for the A/L exam in 2015 from the war torn Northern Province of Sri lanka were given questionnaires to find out the constraints which results in the lack of efficiency of technology students. To find out the level and correlation and the impact of theconstrains, the students were interviewed and their entire term marks were collected. The data was analyzed using descriptive statistical analysis, correlation analysis and regression analysis.Students' marks were normalized and considered as the dependent variable, which shows the efficiency of the students. Teachers' skills, availability of resources to students and the earned marks at the exams(perfomance) are considered as independent variables. According to the results, the relationships between the variables in each technology subjects (Science for Technology, Engineering Technology, and Biological technology)are significantly different. In all three subjects, students' performance influences positively. Teachers' skills influences negatively in science for technology subject and positively in other subjects. The availability of the resource for the studentsinfluences in science for technologypositively while it influences other subjects negatively.

KEY WORDS: *efficiency, performance, teachers' skills and resource availability.*

INTRODUCTION

Technological growth is used to break the vicious circle of poverty. Sri Lanka as a developing country takes some steps towards it by introducing a new stream in the Advanced level (A/L) curriculam in 2013.A/L thestudents have to follow thesubject, Science for Technology (SFT) in this stream, then, they must select either Biosystem technology or engineering technology. In addition, they must select a subject from ten subjects from Arts stream as the 3rd subject.

In the year 2015 ,the students who were admitted to this stream in 2013 sat for the A/L for the first time. However, the results were not satisfactory as there was a high failure rate among the selected sample. As the failure rate in all three subjects was as high as 13 percent and failure rate in any one of the subjects was 42 percent in the sample, it is imperative to carryout diagnostic studies to identify the major constraints that lead to sub - optimal performance. When the pass rate is low it could be a high cost to a community which was already affected by war. This study is conducted with a view to shed light on the issues related to technology stream students in their learning and teaching experiences in the research area.

Many studies have been conducted to find out the constraints on the academic performance of students in different institutions, in different regions.Many of these studies found out the influencing factors are namely, parental influence, personal factors of the students and factors related to teachers (Diaz,2003; Kirubanandham, 2004). However, it should be accepted that the influencing constraints on the performance of the students could vary from place to place, from students to students and in different cultural settings. According to Mlambo.V (2011) the relationships are contingentupon a number of factors such that it is nearly impossible to predict the academic performance of the students.

Therefore, this study is attempting to identify and find out the relationship between students' performance in each technology subjects (namely, Science for Technology, Engineering Technology and Bio System Technology), teachers' skills, and resource availability to students and the efficiency of students (normalized raw marks). Findings of this study might help to improve the performance of the students and thereby avoid the costs that might incur on the community which is already facing many challenges.

LITERATURE REVIEW

To identify the constraints that influence academic performance of students in different contextual settings, numerous studies have been conducted. Various explanations have been canvassed for the poor performance. Many focus on students' demographic factors such as gender, age, race on performance (Devadoss and Foltz, 1996; Walstad and Robinson, 1997), their learning preferences (Pashler, McDanial, Rohrer & Bjork, 2008), class attendance (Durden and Ellis, 1995),Entry qualification and prerequisites (Mlambo,2011). Among these factors, teacher related factors, student related factors are taken up by this study as influencing factors on the efficiency of students, in addition to their performance in the exams measured through earned marks.

METHODS AND METHODOLOGIES

With the following research question, *Why does the technology stream students in NorthernSri Lankan school is showing minimalist out come in their efficiency?*the study attempted to test the following hypothesis:

H_1: The change in students' marks would influence their efficiency.

H_2: The change in skills of would influence their efficiency.

H_3: The change in availability of the resource would influence students efficiency.
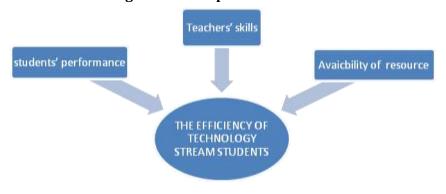
Figure 1: Conceptual Framework

Students' efficiency was considered dependent variable. Students' performance, teachers' skills and the availability of the resource for the students were considered independent variables.

Sampling design:-

Chavakachcheri Hindu College was selected as thatwas the one and only school which offered technology stream as a pioneer in the year 2013 in the Thenmaradchi Division. All the students (100 in number) who sat for the A/L exam in the year 2015 were selected as the target population for the study.

DATA COLLECTION AND ANALYSIS

To collect information, a survey instrument was developed two withparts; Part I is to collect demographic information and PartII is to collect research information. Part II consists of Likert scale type questions with five points.A negative statement gets 5Pointsfor Strongly disagree and 1 point for Strongly agree; Apositive statement gets the points *Vice versa.*

To measure the efficiency, the earned average raw marks was normalized as such the highest score was equated to one and others shows the deviation from it. Then they were divided into five class intervals according to the value and assigned relevant grades.

The following table shows the marks, respective grades and the relevant points used to calculate the performance of the students in each subject.

Table 01: Grading for makes

Range	Grading	Points
100 – 75	A	5
74–66	B	4
65 – 50	C	3
49 – 36	S	2
35 – 00	W	1

Source: developed for research purpose

To find out the level of each variable, the following criteria was developed which could show the contribution of each variable.

Table 02: Criteria

Range	Criteria	Results
$1 \leq Xi < 2.5$	$Xi < 3$	Low level influence of the variable
$2.5 \leq Xi < 3.5$	$Xi = 3$	Moderate level influence of the variable
$3.5 \leq Xi \leq 5$	$Xi > 3$	High level influence of the variable

Source: developed for research purpose

In order to implement the above criteria for assessing the levels of variables and dimensions, the following assumptions are considered.

Assumption 1: A respondent is unbiased or undecided / neutral and maintain a mean value of 3 as population parameter within the Likert scale

Assumption 2:The range for the above unbiasedness ($X_1 = 3$) of a respondent is qualitatively judged within the range of 2.5 – 3.5.

In addition, to understand the relationship between the variables, correlation analysis was carried out. The sign and the value of the correlation coefficient shows the type and the strength of the relationship. To understand the effect of students performance, teachers skills and availability of resources on students' efficiency, the following function was developed: Y=f(X1, X2, X3). To measure the impact of the three independent variables, regression test was carried out with the following equation:

$Y = a + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$

Y- The efficiency of technology steam students

X1- Students' performance (X1.1 , X1.2, X1.3)
X1.1- Science for Technology
X1.2- , Engineering Technology
X1.3- Bio System Technology
X2- Teachers' skills
X3- The availability of the resource for the students
ε- Error

ASSUMPTIONS AND LIMITATIONS

The major assumption was the data given by the students are reliable. It was also assumed that the survey instrument accurately measured students efficiency. The marks obtained by the students are the results of the variables considered in the study. As this study tested only one school, the results obtained may not be amenable to other school in the region. Only three factors namely, the performance of the students, skills of the teachers and availability of resource were taken for the study. Only one batch of students who offered Engineering technology, Bio system technology and Science for Technology were the subjects that were taken into consideration. Teachers were not

given questionnaires to cross check the responses of students could be another limitation for the study.

RESULTS & DISCUSSION

The data were analyzed by using SPSS Version20 and MS Excel. Reliability of the questionnaire was tested with Cronbach's Alpha which was equivalent to 0.818. Descriptive statistical methods (mean and standard deviation, percentage analysis) were usedfor the interpretation of the demographic data. Correlation and multiple regression tests were carried out to find out the association and impact of variables..

(a) Descriptive statistics

When then level of all variables was measured, it registered moderate values for all the variables except teachers skill, which has a high standard deviation.

Table 03: Science for Technology (SFT)

Descriptive Statistics	Mean	Std. Dev	N
Y = Efficiency (normalized marks)	0.58	.11	100
$X_{1.1}$= Performance(term marks average)	2.45	.66	100
X_2=Teachers' skills	3.38	1.15	100
X_3=Availability of the resource	2.94	.89	100

The correlations analysis was used measure the magnitude and the direction of the relationship between Efficiency (Y) and performance (X1.1), Teachers' skills (X2), availability of the resource (X3). The dependent variable , Efficiency (Y) was found to be related significantly to X1.1, X2, X3.

Table 04: Correlation coefficients of SFT

	(Y)	(X1.1)	(X_2)	(X_3)
Efficiency (Y)	1.000			
performance (X1.1)	.963 **	1.000		
Teachers' skills (X2)	-0.26	-.016	1.000	
the availability of the resource (X3)	.096**	.044*	.577*	1.000

** correlation is significant at the 0.00-0.01 level (2- tailed),

* correlation is significant at the 0.00-0.05 level (2- tailed),

Here it is obvious that maximum correlation is existed betweenX1.1and Y, followed by the association of X3 and Y. Low level, negative association was shown between variable X2 and Y, which was insignificant and not supported by the literature.

Regression

The regression analysis generated the following equation, which shows the contribution of each variable to the efficiency in the Science for technology subject.

$Y=18.3+15.9X1.1-0.5X2+1.1X3+\varepsilon$

(0.00) (0.00)(0.081)(0.009)

R^2= 0.932 (0.000)

If X1.1 (performance) increases by 1%, (Y) Efficiency increases by 15.9%, whereas the change in X3 (available resources) increases the Y by 1.1% which was a smaller contribution than X1.1. However, X2 (teachers' skills) shows a negative and insignificant effect on efficiency. This finding is in disagreement with Felder (1993), who established that an association exists between teaching skills and academic performance.

II) Engineering Technology

The table below shows the descriptive statistics of the second subject of the Technology stream students. Out of the 100 students, this subject was taken by 59 students. Independent variables have low (X1.1) and moderate level (X2, X3) influence on the dependent variable.

Table 05: Engineering Technology (ET)

Descriptive Statistics	Mean	Std. Deviation	N
Efficiency (Y)	0.543	0.11	59
Performance (X1.2)	2.37	0.65	59
Teachers' skills (X2)	3.47	1.17	59
Availability of the resource (X3)	2.95	0.73	59

Source: fieldwork 2015

Table 06: Correlationcoefficient of ET

	ET Efficiency (Y)	performance (X1.2)	Teachers' skills (X2)	availability of resource (X3)
Performance (X1.2)	**.967	1.000		
Teachers' skills (X2)	.096	.093	1.000	
Availability of the resource (X3)	-.214	.270*	.472*	1.000
** correlation is significant at the 0.00-0.05 level (2- tailed),				

Positive, strong correlation existed between X1.2 and Y,. Low and insignificant level influence of the variable X3 on Y was registered.Lowand negative association of the variable X3 with Y was not supported by the literature. However, the X1.2 variable positively and significantly correlated with performance. Likewise the inter correlation between X2 and X3, was positive and significant which was supported by the literature.

Table 07: Regression results of Engineering Technology

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.162	.019		8.510	.000
performance of ET(X1.2)	.169	.006	.982	28.262	.000
Teachers' skills (X2)	.003	.004	.037	.974	.334
availability of resource (X3)	-.010	.006	-.068	-1.740	.087
R²	0.939				.000
a. Dependent Variable: Engineering technology students (normalized marks) Efficiency					

Source: fieldwork 2015

From the above table, the effect of each variable on efficiency is shown as follows: $Y=16.2+16.9X1+0.03X2-1X3+\varepsilon$

(0.000)(0.000)(0.334)(0.087)

The table above gives that If X1.2 increases by 1%, Y increases by 16.9%. X2 and X3 are not depicting the expected results. However, the model didn't explain 6.1% of the variation of Y, which could be is related to other variables which are not depicted in the model.

III) Bio System Technology (BST)

The third subject offered in the technology stream was Bio System Technology (BST). Out of the sample, 41 students offered this subject.Descriptive analysis shows Independent variables have moderate level (X1.3, X2, X3) influence on the dependent variable. It could be noted that the standard deviation is quiet big and shows high variation inthe answers.

Table 08: Bio System Technology (BST)

Descriptive Statistics			
	Mean	**Std. Deviation**	**N**
BST students Efficiency (X1.3)	.6381	.14922	41
BST performance (X2)	2.9263	.98466	41
Teachers' skills (X3)	3.3012	1.13955	41
availability of the resources	2.9518	1.09935	41

To understand the association between the variables and their direction and strength correlation analysis was carried out.Efficiency (Y)) was found to be related significantly to X1.3, whereas the other two variables show lack of meaningful association with efficiency. This might be a result of the questionnaire failing to assess the influence of these factors accurately. It could be noted that there is a strong positive correlation between teachers' skills and availability of resources. It could therefore be argued that an increase in resources could be helpful to teachers as well.

Table 09: Correlation- Bio System Technology

	Efficiency (Y)	performance (X1.3)	Teachers' skills(X2)	availability of resource(X3)
Efficiency (Y)	1.000			
performance (X1.3)	**.988	1.000		
Teachers' skills (X2)	.277	.293	1.000	
Availability of resource (X3)	-.045	-.027	**.734	1.000
** correlation is significant at the 0.00-0.05 level (2- tailed), N – 38				

Since the correlation did not provide meaningful results, a regression test was performed to find out the impact of each variable on the efficiency measured through the subject Bio System Technology.

Table 10: Regression- Bio System Technology

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	**Std. Error**	**Beta**		
(Constant)	.208	.017		12.538	.000
performance of BST Teachers' skills availability of the resource	.150	.005	.987	32.948	.000
	.000	.006	.002	.044	.065
	-.003	.006	-.020	-.472	.040
	$R^2 =. 976$				
a. Dependent Variable: bio system technology students Efficiency					

Based on the table the following equation was formulated to show the effect of each variable on efficiency:
$Y=20.8+15X1+X2-0.03X3+\varepsilon$

The function above gives that, X1.3 causes 15% variation in Y, whereas, if X2 increases, Y increases by the same percentage . That means, there is a one to one relationship between Teachers skills and the students efficiency in the Bio System Technology. The X3 variable contributes a very small variation in Y, which is equals to 3% and in the opposite direction.

Summary of Results

	H1	H2	H3
Science for Technology	Accept (Positive)	Reject (Negative)	Accept (Positive)
Engineering Technology	Accept (Positive)	Reject (Positive)	Reject (Negative)
Bio System Technology	Accept (Positive)	Accept (*) (Positive)	Reject (Negative)
* - Signification at 0.1			

CONCLUSION

This study examined the factors that affect Technology stream students' performance at the Chavachcheri Hindu College. The results of this study, based on the three hypotheses evidently assert that students' performancehas a direct and positive impact on efficiency of the students which was measured through normalized marks of respective subjects, namely, Science for Technology, Engineering Technology and Bio system technology. The findings also highlights that the variable Teachers Skills didn't have a significant effect on efficiency except Bio Systems Technology. This calls for the enhancement of knowledge of the teachers and by taking immediate actions such as teacher trainings, workshops and others to make their contribution up to date. Resource availability also not had a significant effect exceptScience for technology subject. Since the study location was a war torn sub urban area, materials, machines and skilled manpower were stated not satisfactory to support this newly introduced course. A closer analysis of the above mentioned determinants could be helpful, as resource availability and teachers' skills had a strong and positive correlation. It is indicated from the study that further analysis is needed to identify the other constraints which might affect the efficiency of the students. It is accepted that the list of factors investigated in the study was not exhaustivesincethere can be internal as well as external factors that could affect student performance. Factors known to influence academic performance of the students such as learning preferences, attendance, entry qualifications, and student motivation could be analyzed. If the constraints are identified which compel the students to lag behind, corrective measures could be offered to students as well as teachers.

REFERENCES

1. Aggaral.J.C (2000) Essential of educational technology learning
2. Gagne.R.M.Briggs.L.J. Wager.W.W. (1992), Principles of Instructional Design, Harcourt Brace Javanavich College publishers fort worth 4th edition.
3. Devadoss, S., & Foltz, J. (1996). Evaluation of factors influencing students attendance and performance. American Journal of Agricultural Economics, 78(3), 499 – 507.
4. Durden, G. C., & Ellis, L. V. (1995). The effects of attendance on student learning in principles ofeconomics. American Economic Review, 85(2), 343–346.
5. Kirupanatham.K (2004), Interest of A/L Student towards the newly introduced DIP, Graduate Studies, University of Jaffna.
6. Pashler, H., McDaniel, M., Rohrer, D., & Bjork, R. (2008). Learning styles: Concepts and Evidence. Psychological Science in the Public Interest, 9(3), 106 – 119.
7. Rogers.B.C. (1995) pp 1 ,Behavior Management: A whole school Approach, Ashton sclotnstic, Melbourne.
8. Sadler.D. (1998) pp 256, "Formative Assessment and the design of instructional systems. Instructional science Vol. – 18", Science Association, Colombo.
9. Mlambo.V (2011), Caribbean Teaching Scholar, Vol. 1, No. 2, Nov. 2011, 79–92.
10. Web sites:
    a. http://www.education.gov.lk. Ministy of education, Sri Lanka.
    b. http://www.live.journal.com
11. Harb.N and Shaarawi.A.E (2006) http;//mpra.ub.uni-muenchen.de/13621/