

# Effective Data Analytic Framework for Secondary Education in Sri Lanka

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**Abstract:-** The significance of data operation for perfecting policymaking (at the system position), operation of seminaries and educational approaches in the classroom. Data are most useful in educational decision- timber when the purpose extends beyond perpendicular responsibility and toward academy and classroom- position decision- timber, which enhances the experience and achievement of scholars. This exploration also illustrate how more sophisticated forms of analytics and identification of the being problems in the sphere are gradationally substituting traditional data analyses. In addition, this exploration paves the path for exploration sphere that seeks to ameliorate educational assessment, tutoring, and pupil learning through data analytics. Substantially this system fastening on developing a theoretical frame by defining the criteria for different personals who are involving to the secondary education system. This exploration is going to use the data analytics grounded on the different criteria's which can support for the data assaying of the scholars and relating the features which can support to make the better opinions to ameliorate the quality and the effectiveness of the secondary education and making the advancements of the student performance.

**Keywords:-** Framework: a Basic Conceptual Structure (as of Ideas).

## I. INTRODUCTION

Despite the emotional expansion of training openings over the once decades, education quality and equity remain major enterprises in Sri Lanka. With the Sustainable Development Goals (SDGs) and Education 2030 docket, the shift in emphasis towards the quality of education is apparent and exercising data will be pivotal to informing stylish practices in education. Learning assessments, whether at transnational, indigenous or public situations, and effective use of their data, have great eventuality to increase the quality of education. With SDG 4 and Education 2030, Sri Lanka needs to develop pointers that can directly reflect their progress towards these pretensions. The same capacity can be applied to learning assessment data and exercising the substantiation to directly and efficiently inform education policy. Numerous countries have decreasingly turned to transnational assessments similar as the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS), in order to give the stamp of blessing on their educational issues. Transnational assessments garner significant attention, and with the results making caption news, countries are suitable to hold themselves up on a

pedestal should they reach the upper league of the transnational rankings. The fashion ability of these assessments therefore cannot be denied, particularly for developing countries, who strive to contend on the transnational stage. PISA and other transnational assessments, in numerous cases, are the measuring stick they seek. Indeed for countries that haven't shared in transnational assessments, the results of public examinations and assessments suggest wide difference within the country and in some cases, indicate a veritably low position of learning indeed after scholars have spent times in academy. [1]

In addition, Sri Lanka, these assessments aren't without limitations. For illustration, test particulars are designed generally around cognitive chops, making it delicate to truly assess other chops similar as creativity, communication, and collaboration, chops which are just as critical to literacy. Still, scholars' scores aren't the only precious information which can be picked from these assessments. Indeed, the results and the data that's collected can be extremely useful at relating underpinning sins and challenges. Assessments gather vast quantities of data, not only on scholars' scores, but on information applicable to seminaries, preceptors, and homes.

This data can be pivotal and can lead to important opinions and changes in education systems. It's this large quantum of data that offers an occasion for secondary analysis. Learning assessments can be important tools for informing and reforming education policy. Still, the use of education data to address education policy is fairly incipient in Sri Lanka but left without the means to dissect or use this vast knowledge bank. The capability to dissect a variety of data and interpret the factors that can contribute to or influence literacy has the implicit to make the education system more effective, to place precedence on issues that may not have been linked else and to grease better decision-making for the investment and allocation of coffers.

This report aims to find out how we can more dissect and use literacy assessment data and design and apply programs to ameliorate literacy grounded on substantiation. It provides a shot of the colorful challenges that countries face in terms of effectively exercising assessment results and responding to the trends that are being within their surrounds. Further work needs to be done; particularly with regard to strengthening the capacity of education systems, but the results shown then give a good assignment for unborn policy and exploration and for the good frame for the Analytical styles.

Developing countries face multiple challenges in perfecting their education system’s capability to meet ambitious pretensions related to access, quality, and equity. Limited coffers, as well as poor or missing information on colorful confines of the system, hampers progress. Adding the vacuity and use of data and substantiation is a critical arena for leadership and operation in the education sector. The call for further and better data has been heard and while investment in education data lags some other sectors, it has increased and bettered. Still, a data- driven system isn't just about generating data. It's also about increased appreciation for and use of substantiation. Several factors stymie data use. Decision-makers and other stakeholders may not know what data are available if data directors don't invest enough in dispersion or participating the data extensively, if at all. The available data may not be the right substantiation, that is, substantiation that's applicable to the opinions and issues at hand, available at the time it's demanded, and in a form that can be penetrated, understood, and applied. Investments in an effective public education information system will pay off in terms of better data and further data use Failings in the quality of education data inaccuracies, uneven content, closed data, and detainments in vacuity erode trust in information and ultimately discourage use. But more important than emphasizing the advancements demanded in specific data is developing a functional, dependable information system that not only collects and stores data but also has the capacity to partake and circulate data to inform views and opinions.

Grounded on the literature review linked that their different circle holes were there in the being methodologies. The one aspect is that developing each tool need the complex kind of technologies and they're targeting on one particular area. So those can be applied to break one specific kind of problem. Another aspect is to develop these tools takes high cost. Since SriLanka is a developing country need to look at a result where it can be available in lowcost.so that need to look a system where can get use with low cost. Since all the being generalities consists of the specialized aspects so that policy makers like preceptors, star and other affiliated authorities ca n’t use itproperly.so concern is to introduce a frame as well as an automated system with lower specialized generalities but also furnishing a better point.

**II. METHODOLOGY**

The proposed study entitled “ Effective Data Analytic Framework for Secondary Education in Sri Lanka” is to be conducted as a mixed (Quantitative and Qualitative grounded) experimental grounded exploration cause where it identifies some criterias conducted with a scientific approach and set of criterias are kept constant while the other set of criterias are being measured as the subject of trial. This attempts to concentrate on furnishing cost effective, stoner friendly, assaying tool which can estimate the scholars’ performance and making better opinions to enchase the quality of the education.

*A. Theoretical Framework*

Figure 1 Illustrates the conceptual model created based on the Literature review

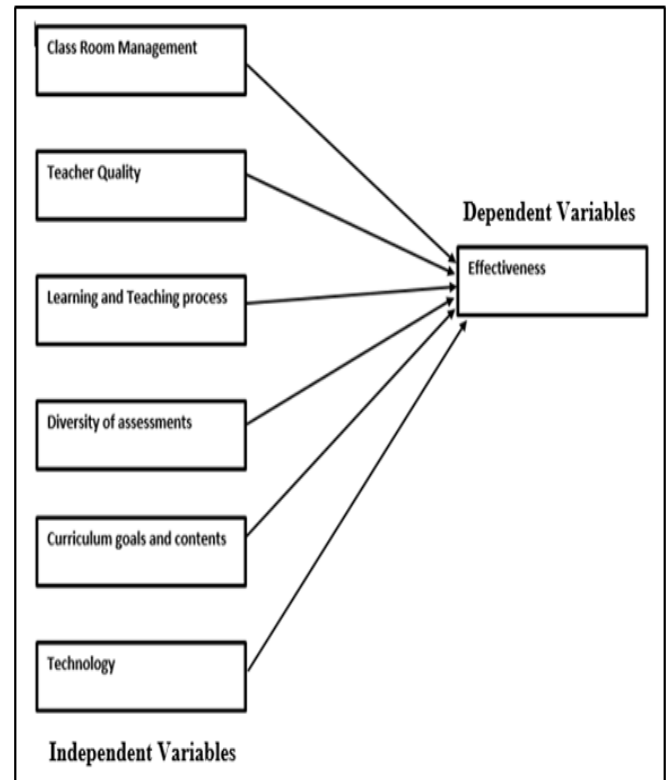


Fig 1 Conceptual Framework

➤ *The Conceptual Framework Considered the Following Factors Listed Down.*

- *Classroom Management*
  - ✓ Class Size
- *Teacher Quality*
  - ✓ Teacher Education
  - ✓ Job Experience
  - ✓ Professional Development
  - ✓ Trainings
- *Learning and Teaching Process*
  - ✓ Sharing learning objectives with students
  - ✓ Effective questioning
  - ✓ Example: wait /pause time and variety of question types (open /closed questions - content centered to student centered)
  - ✓ Observations (ex: body language /facial expressions)
  - ✓ Peer learning (listening and reflecting on other student answers in whole class setting)
  - ✓ Effective feedback (clear advice for improvement /reinforcement)
  - ✓ Active involvement of student in their own learning
  - ✓ Early preparations

- *Diversity of Assessments*
- ✓ Different models of assessments (pen /pencil based or projects) to match learning objectives and processes.
- ✓ Different parties (Example: self /peer /teachers /parents) evaluation
- ✓ Different Strategies to access the quality of learning
- *Example: Setting Assessments that are Both Challenging and Suitable for Student’s Competence.*
- *Curriculum Goals and Contents*
- *Technology*

➤ *All these Factors Measured against the Effectiveness to Identify any Relationship between the Variables Specified.*

The followings are the hypothesis consider for the analysis

- *H1: There is an association between Classroom Management and Effectiveness.*
- *H2: There is an association between Teacher Quality and Effectiveness.*
- *H3: There is an association between Learning & teaching Process and Effectiveness.*
- *H4: There is an association between Diversity of assessments and Effectiveness.*
- *H5: There is an association between Curriculum goals and contents and Effectiveness.*

### III. RESULTS & DISCUSSION

#### A. Results from CHI-SQAURE TEST for Demographic Factors

##### ➤ Relationship between Gender & Effectiveness

The following table 1 shows the relationship between the gender and effectiveness.

Table 1 CHI SQUARE TEST for Gender & Effectiveness

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.447 <sup>a</sup>	10	.585
Likelihood Ratio	9.773	10	.461
Linear-by-Linear Association	.698	1	.403
N of Valid Cases	70		

Since Pearson Chi-Square values is 0.585 and greater than to the 0.05 there is no association between the gender and effectiveness.

##### ➤ Relationship between Age & Effectiveness

The following table 2 shows the relationship between the age and effectiveness.

Table 2 CHI SQUARE TEST for Age & Effectiveness

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	31.322 <sup>a</sup>	40	.835
Likelihood Ratio	34.327	40	.723
Linear-by-Linear Association	1.678	1	.195
N of Valid Cases	70		

Since Pearson Chi-Square values is 0.835 and greater than to the 0.05 there is no association between the age and effectiveness.

##### ➤ Relationship between Qualifications & Effectiveness

The following table 3 shows the relationship between the qualifications and effectiveness.

Table 3 CHI SQUARE TEST for Qualifications & Effectiveness

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	26.771 <sup>a</sup>	30	.635
Likelihood Ratio	30.744	30	.428
Linear-by-Linear Association	2.392	1	.122
N of Valid Cases	70		

Since Pearson Chi-Square values is 0.635 and greater than to the 0.05 there is no association between the qualifications and effectiveness.

➤ *Relationship between Experience & Effectiveness*

The following table 4 shows the relationship between the experience and effectiveness.

Table 4 CHI SQUARE TEST for Experience & Effectiveness

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	41.060 <sup>a</sup>	40	.424
Likelihood Ratio	44.470	40	.289
Linear-by-Linear Association	.667	1	.414
N of Valid Cases	70		

Since Pearson Chi-Square values is 0.424 and less than to the 0.05 there is an association between the experience and effectiveness.

➤ *Relationship between Participation for the Trainings and Effectiveness*

The following table 5 shows the relationship between the participation of trainings and effectiveness.

Table 5 CHI SQUARE TEST for Participation for Trainings & Effectiveness

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.973 <sup>a</sup>	10	.360
Likelihood Ratio	11.075	10	.352
Linear-by-Linear Association	2.677	1	.102
N of Valid Cases	70		

Since Pearson Chi-Square values is 0.360 and less than to the 0.05 there is an association between the participation for the trainings and effectiveness.

➤ *Relationship between no of Trainings and Effectiveness*

The following table 6 shows the relationship between the participation of trainings and effectiveness.

Table 6 CHI SQUARE TEST for no of Trainings & Effectiveness

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	31.592 <sup>a</sup>	36	.678
Likelihood Ratio	35.014	36	.515
Linear-by-Linear Association	4.071	1	.044
N of Valid Cases	58		

Since Pearson Chi-Square values is 0.678 and greater than to the 0.05 there is no association between the no of trainings and effectiveness.

➤ *Relationship between no of Trainings and Effectiveness*

The following table 7 shows the relationship between the class size and effectiveness.

Table 7 CHI SQUARE TEST for Class Size & Effectiveness

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	41.870 <sup>a</sup>	40	.390
Likelihood Ratio	47.091	40	.205
Linear-by-Linear Association	.696	1	.404
N of Valid Cases	70		

Since Pearson Chi-Square values is 0.390 and less than to the 0.05 there is an association between the class size and effectiveness.

➤ *Relationship between usage of Statistical Approach and Effectiveness*

The following table 8 shows the relationship between the usage of statistical approach and effectiveness.

Table 8 CHI SQUARE TEST for usage of statistical approach & Effectiveness

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.507 <sup>a</sup>	10	.064
Likelihood Ratio	19.486	10	.035
Linear-by-Linear Association	.279	1	.597
N of Valid Cases	70		

Since Pearson Chi-Square values is 0.064 and less than to the 0.05 there is an association between the usage of statistical approach and effectiveness.

*B. Results from Factor Analysis*

➤ *Learning and Teaching process*

• *Sharing Learning Objectives with Students*

In this hypothesis there are four particulars, for each particular is studied on a Likert scale of 1 to 5 where the attesters of 1 indicates strongly oppose whereas response of 5 indicates Strongly admit to the declaration. The descriptive statistics summary and the inter correlation for particular values are given in table 9.

Table 9 Descriptive Statistics Summary and Inter Correlation for items in Sharing Learning Objectives with Students

		<b>FQ1</b>	<b>FQ2</b>	<b>FQ3</b>	<b>FQ4</b>	<b>FQ5</b>	<b>FQ6</b>
Correlation	FQ1	1.000	.312	.123	.442	.131	.370
	FQ2	.312	1.000	.246	.334	.151	.174
	FQ3	.123	.246	1.000	.452	.343	.168
	FQ4	.442	.334	.452	1.000	.541	.369
	FQ5	.131	.151	.343	.541	1.000	.455
	FQ6	.370	.174	.168	.369	.455	1.000

Depend on the mean values in table 9, there seems to agreement in all 4 as sometimes on Sharing learning objects with scholars. The topmost correlation for each item with at least one other item in the construct is between 0.3 and 0.9. Therefore, the entire 4 particulars linked satisfactorily in the construct.

• *Effective Feedback*

In this hypothesis there are two particulars, for each particular is studied on a Likert scale of 1 to 5 where the attesters of 1 indicates strongly oppose whereas response of 5 indicates Strongly admit to the declaration. The descriptive statistics summary and the inter correlation for item values are given in table 10.

Table 10 Descriptive Statistics Summary and Inter Correlation for items in effective feedback

		<b>EQ1</b>	<b>EQ2</b>
Correlation	EQ1	1.000	.545
	EQ2	.545	1.000

Depend on the mean values in table 10, there seem like to agreement in all 2 as sometimes on effective feedback. Therefore, the entire 2 items correlated satisfactorily in the construct.

• *Active Involvement of Student in their own Learning.*

In this hypothesis there are six particulars, for each particular is studied on a Likert scale of 1 to 5 where the attesters of 1 indicates strongly oppose whereas response of 5 indicates Strongly admit to the declaration. The descriptive statistics summary and the inter correlation for particular values are given in table 11.

Table 11 Descriptive Statistics Summary and Inter Correlation for Items in Active Involvement of Student in their own Learning

	<b>Value</b>	<b>df</b>	<b>Asymp. Sig. (2-sided)</b>
Pearson Chi-Square	41.870 <sup>a</sup>	40	.390
Likelihood Ratio	47.091	40	.205
Linear-by-Linear Association	.696	1	.404
N of Valid Cases	70		

Based on the mean values in table 11, there seems to agreement in all 6 as sometimes on active involvement of student in their own learning. The highest correlation for each item with at least one other item in the construct is between 0.3 and 0.9. Therefore, the entire 6 items correlated satisfactorily in the construct.

➤ *Diversity of Assessments*

To estimate the diversity of assessments had only one question, so that can ignore chancing the descriptive statistics and the inter item correlation values.

➤ *Curriculum Goals and Contents*

To estimate the class pretensions and contents had only one question, so that can ignore chancing the descriptive statistics and the inter item correlation values.

➤ *Technology*

In this hypothesis there are five particulars, for each item is studied on a Likert scale of 1 to 5 where the repliers of 1 indicates explosively oppose whereas response of 5 indicates Explosively admit to the protestation. The descriptive statistics summary and the inter correlation for particular values are given in table 12.



Table 12 Descriptive Statistics Summary and Inter Correlation for items in Technology

		<b>IQ1</b>	<b>IQ2</b>	<b>IQ3</b>	<b>IQ4</b>	<b>IQ5</b>
Correlation	IQ1	1.000	.655	.506	.362	.386
	IQ2	.655	1.000	.731	.475	.444
	IQ3	.506	.731	1.000	.493	.457
	IQ4	.362	.475	.493	1.000	.194
	IQ5	.386	.444	.457	.194	1.000

Based on the mean values in table 8, there seems to agreement in all 5 as sometimes on technology. The highest correlation for each item with at least one other item in the construct is between 0.3 and 0.9. Therefore, the entire 7 items correlated satisfactorily in the construct.

➤ *Effectiveness*

In this thesis there are four particulars, for each item is studied on a Likert scale of 1 to 5 where the repliers of 1 indicates explosively oppose whereas response of 5 indicates Explosively admit to the protestation. The descriptive statistics summary and the inter correlation for item values are given in table 13.

Table 13 Descriptive Statistics Summary and Inter Correlation for Effectiveness

		<b>Average Marks</b>	<b>Noof Compalins</b>	<b>Noof Recorrections</b>	<b>Repts</b>
Correlation	Average_Marks	1.000	.722	.725	.519
	Noof Compalins	.722	1.000	.437	.495
	Noof Recorrections	.725	.437	1.000	.643
	Repts	.519	.495	.643	1.000

Grounded on the mean values in table 13, there seems to agreement in all 4 as occasionally on effectiveness. The loftiest correlation for each item with at least one other item in the construct is between 0.3 and 0.9. Thus, the entire 4 particulars identified satisfactorily in the construct.

C. *Results from Regression Analysis*

➤ *Relationship between Learning Teaching Practices & Effectiveness*

Figure 2 shows the learning teaching practices on the effectiveness. By referring, the residual plot there is a relationship between the learning teaching practices and the effectiveness. Because in the residual plot, all the points are falling within +3 and -3 and are scattered randomly.

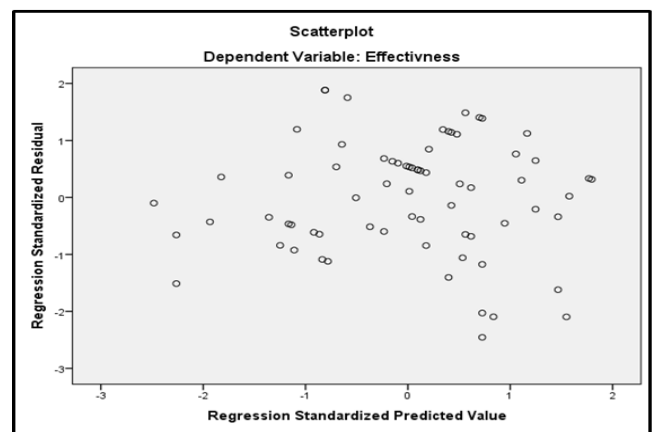


Fig 2 Residual Plot for Learning and Teaching Practices & Effectiveness

Table 14 Correlation between Learning Teaching Practices & Effectiveness

<b>Correlations</b>			
		<b>Effectiveness</b>	<b>LTP</b>
Pearson Correlation	Effectiveness	1.000	.555
	LTP	.555	1.000
Sig. (1-tailed)	Effectiveness	.	.000
	LTP	.000	.
N	Effectiveness	70	70
	LTP	70	70

In between the learning teaching practices and the effectiveness Pearson’s Correlation co-efficient(r) is 0.555. To have a relationship r-value should be in 0.3-0.9. That means there is a relationship between the variables considered.

Table 15 ANOVA table for Learning Teaching Practices & Effectiveness

<b>Model</b>		<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
1	Regression	4.478	1	4.478	11.118	.001 <sup>b</sup>
	Residual	27.387	68	.403		
	Total	31.865	69			

- The p value =0.000, that means it is less than to 0.05.so that effectiveness depends on the learning teaching practices.

➤ Relationship between Diversity of Assessments & Effectiveness

Figure 3 shows the diversity of assessments on the effectiveness. By referring, the residual plot there is a relationship between the diversity of assessments and the effectiveness. Because in the residual plot, all the points are falling within +3 and -3 and are scattered randomly.

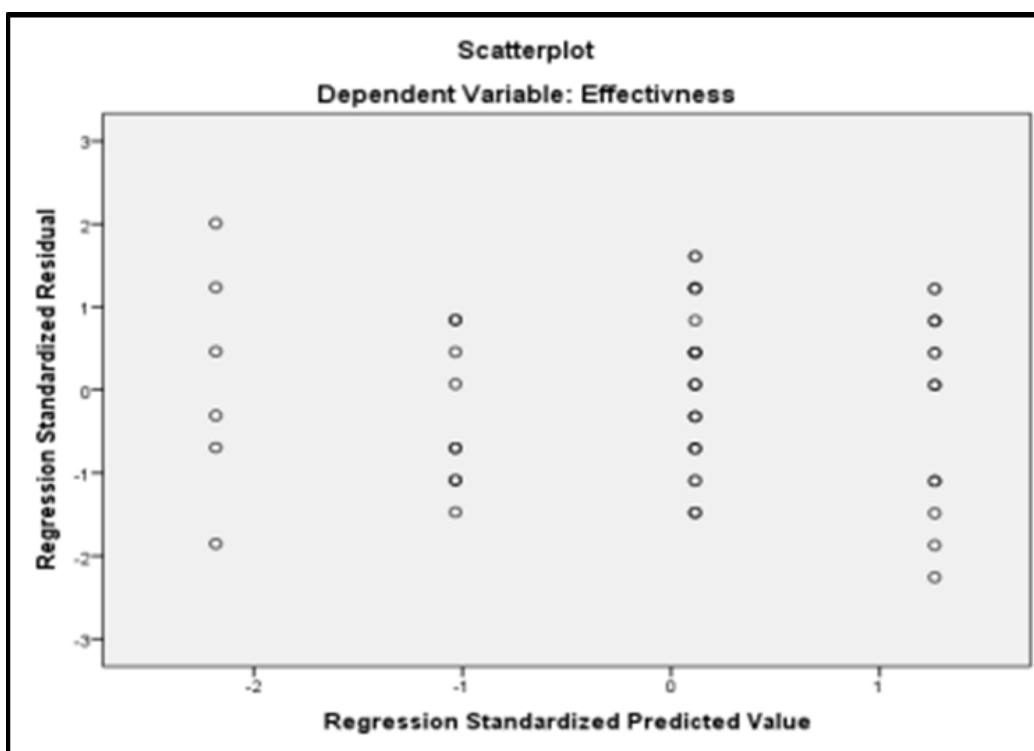


Fig 3 Residual Plot for Diversity of Assessments & Effectiveness

Table 16 Correlation between Diversity of Assessments & Effectiveness

<b>Correlations</b>			
		<b>Effectiveness</b>	<b>BQ1</b>
Pearson Correlation	Effectiveness	1.000	.375
	BQ1	.375	1.000
Sig. (1-tailed)	Effectiveness	.	.001
	BQ1	.001	.
N	Effectiveness	70	70
	BQ1	70	70

In between the diversity of assessments and the effectiveness Pearson’s Correlation co-efficient(r) is 0.375. To have a relationship r-value should be in 0.3-0.9. That means there is a relationship between the variables considered.

Table 17 ANOVA Table for Diversity of Assessments & Effectiveness

<b>Model</b>		<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
1	Regression	9.341	1	9.341	30.243	.000 <sup>b</sup>
	Residual	21.002	68	.309		
	Total	30.343	69			

- The p value =0.001, that means it is less than to 0.05.so that effectiveness depends on the learning teaching practices.

➤ Relationship between Curriculum Goals and Contents & Effectiveness

Figure 4 shows the Curriculum goals and contents on the effectiveness. By referring, the residual plot there is a relationship between the diversity of assessments and the effectiveness. Because in the residual plot, all the points are falling within +3 and -3 and are scattered randomly.

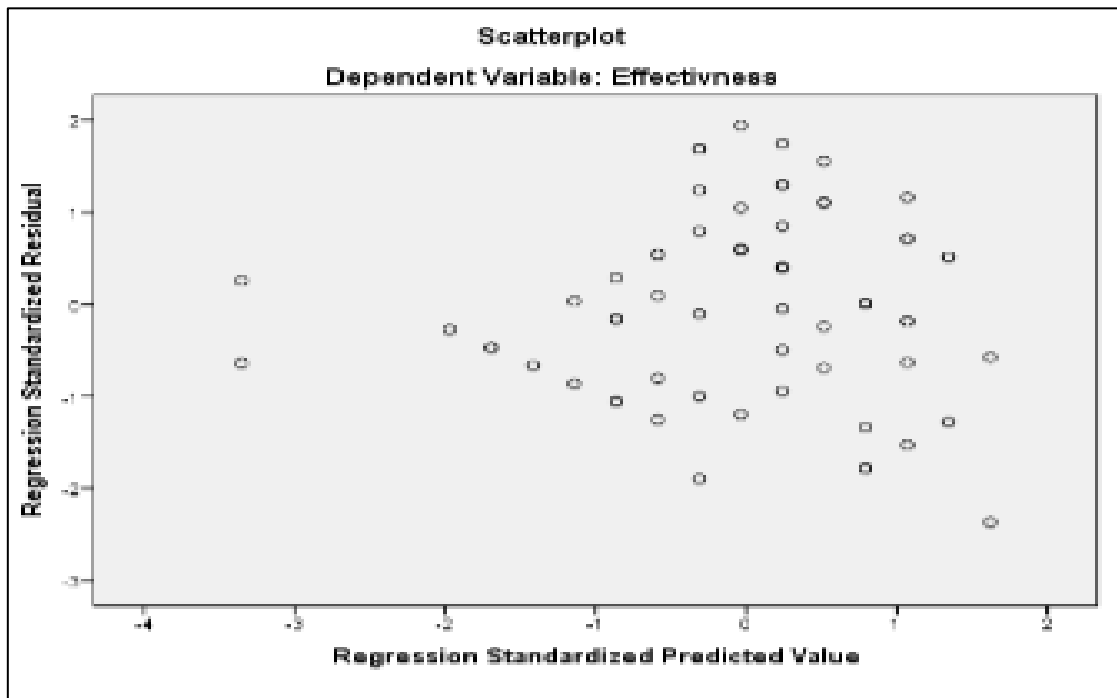


Fig 4 Residual Plot for Curriculum Goals and Contents & Effectiveness

Table 18 Correlation between Curriculum Goals and Contents & Effectiveness

		<b>Effectiveness</b>	<b>CQ1</b>
Pearson Correlation	Effectiveness	1.000	.325
	CQ1	.325	1.000
Sig. (1-tailed)	Effectiveness	.	.003
	CQ1	.003	.
N	Effectiveness	70	70
	CQ1	70	70

In between the Curriculum goals and contents and the effectiveness Pearson’s Correlation co-efficient(r) is 0.325. To have a relationship r-value should be in 0.3-0.9. That means there is a relationship between the variables considered.

Table 19 ANOVA table for Curriculum goals & Effectiveness

<b>Model</b>		<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
1	Regression	3.370	1	3.370	8.041	.006 <sup>b</sup>
	Residual	28.496	68	.419		

The p value =0.006, that means it is greater than to 0.05.so that effectiveness is dependent on the curriculum goals and contents.

➤ *Relationship between Technology and Contents & Effectiveness*

Figure 5 shows the technology on the effectiveness. By referring, the residual plot there is a relationship between the technology and the effectiveness. Because in the residual plot, all the points are falling within +3 and -3 and are scattered randomly.

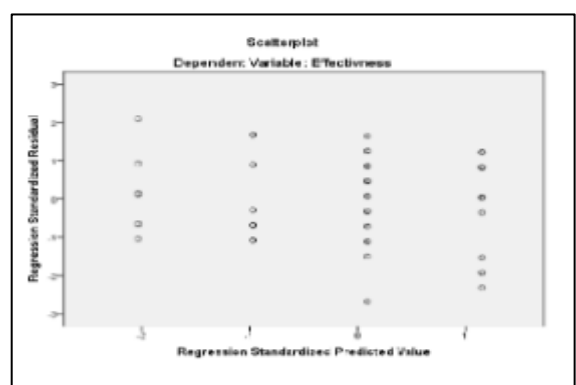


Fig 5 Residual Plot for Technology and Contents & Effectiveness



Table 20 Correlation between Technology and contents &amp; Effectiveness

		<b>Effectivness</b>	<b>Technology</b>
Pearson Correlation	Effectivness	1.000	.581
	Technology	.581	1.000
Sig. (1-tailed)	Effectivness	.	.000
	Technology	.000	.
N	Effectivness	70	70
	Technology	70	70

In between the technology and the effectiveness Pearson's Correlation co-efficient(r) is 0.581. To have a relationship r-value should be in 0.3-0.9. That means there is a relationship between the variables considered.

Table 21 ANOVA table for Technology &amp; Effectiveness

<b>Model</b>		<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
1	Regression	10.759	1	10.759	34.661	.000 <sup>b</sup>
	Residual	21.107	68	.310		
	Total	31.865	69			

- The p value =0.000, that means it is less than to 0.05.so that effectiveness depends on the technology.

#### IV. CONCLUSION

➤ Based on the Data Analysis the Followings can be Consider as the Decisions were Made.

- There is a relationship between Classroom Management and Effectiveness.
- There is a relationship between Teacher Quality and Effectiveness.
- There is a relationship between Learning & teaching Process and Effectiveness.
- There is a relationship between Diversity of assessments and Effectiveness.
- There is a relationship between Curriculum goals and contents and Effectiveness.
- There is a relationship between Technology and Effectiveness

During the data analysis process majorly consider whether defined hypothesis can have proofed or not.

#### REFERENCES

- [1]. <https://unesdoc.unesco.org>[Accessed:13/07/2018]
- [2]. Bowers, A. J. (2008). 'Promoting Excellence: Good to great, NYC's district 2, and the case of a high performing school district'. Leadership and Policy in Schools, 7(2), 154-177.
- [3]. Mandinach, E. B., Honey, M., Light, D., & Brunner, C. (2008). 'A Conceptual Framework for Data-Driven Decision Making'. In E. B. Mandinach & M. Honey (Eds.), Data-Driven School Improvement: Linking Data and Learning (pp. 13-31). New York: Teachers College Press.
- [4]. Wayman, J. C. (2005). 'Involving teachers in datadriven decision making: Using computer data systems to support teacher inquiry and reflection'. Journal of Education for Students Placed at Risk, 10(3), 295-308.
- [5]. Wayman, J. C., Stringfield, S., & Yakimowski, M. the analysis of student data' (Report No. 67). Baltimore, MD: Johns Hopkins University, Center for Researc on the Education of Students Placed At Risk.
- [6]. Bernhardt, V. L. (2004). Data Analysis for Continuous School Improvement (2 ed.). Eye On Education
- [7]. Davies, P. (1999). 'What is evidence-based education?', British Journal of Educational Studies, 47(2), 108-121.
- [8]. Slavin, R. E. (2002). 'Evidence-based education policies: Transforming educational practice and research'. Educational Researcher, 31(7), 15-21.
- [9]. Daniel, B. (2015). 'Big Data and analytics in higher education: Opportunities and challenges'. British Journal of Educational Technology, 46(5), 904-920.
- [10]. Cope, B., & Kalantzis, M. (2016). 'Big Data Comes to School'. AERA Open, 2(2), 1-19.
- [11]. Gandomi, A., & Haider, M. (2015). 'Beyond the hype: Big data concepts, methods, and analytics'. International Journal of Information Management, 35(2), 137-144
- [12]. Schutt, R., & O'Neil, C. (2013). Doing Data Science: Straight Talk from the Frontline. Cambridge, MA: O'Reilly.
- [13]. Baker, R. S., & Yacef, K. (2009). 'The State of Educational Data Mining in 2009: A Review and Future Visions'. Journal of Educational Data Mining, 1(1), 3-16.
- [14]. Koedinger, K. R., D'Mello, S., McLaughlin, E. A., Pardos, Z. A., & Rosé, C. P. (2015). 'Data mining and education'. Wiley Interdisciplinary Reviews: Cognitive Science, 6(4), 333-353.
- [15]. Romero, C., & Ventura, S. (2010). 'Educational data mining: a review of the state of the art'. Systems, Man, and Cybernetics, Part C: Applications and Reviews, IEEE Transactions on, 40(6), 601-618.

- [16]. Bowers, A. J., Krumm, A. E., Feng, M., & Podkul, T. (2016). 'Building a Data Analytics Partnership to Inform School Leadership Evidence-Based Improvement Cycles'. Paper presented at the Annual meeting of the American Educational Research Association, Washington, DC.
- [17]. Cho, V., & Wayman, J. C. (2015). 'Districts' Efforts for Data Use and Computer Data Systems: The Role of Sensemaking in System Use and Implementation'. *Teachers College Record*, 116(2), 1-45.
- [18]. Behrens, J. T., & DiCerbo, K. E. (2014). Technological Implications for Assessment Ecosystems: Opportunities for Digital Technology to Advance Assessment. *Teachers College Record*, 116(11), 1-22.
- [19]. Bowers, A. J. (2017). 'Quantitative Research Methods Training in Education Leadership and Administration Preparation Programs as Disciplined Inquiry for Building School Improvement Capacity. *Journal of Research on Leadership Education*, 12(1), p.72-96. <http://doi.org/10.1177/1942775116659462>.
- [20]. Bowers, A. J., Shoho, A. R., & Barnett, B. G. (2014). 'Considering the Use of Data by School Leaders for Decision Making'. In A. J. Bowers, A. R. Shoho & B. G. Barnett (Eds.), *Using Data in Schools to Inform Leadership and Decision Making* (pp. 1-16). Charlotte, NC: Information Age Publishing.
- [21]. Koedinger, K. R., Baker, R. S., Cunningham, K., Skogsholm, A., Leber, B., & Stamper, J. (2010). 'A data repository for the EDM community: The PSLC DataShop'. In C. Romero, S. Ventura, M. Penchenizkiy & R. S. Baker (Eds.), *Handbook of Educational Data Mining* (pp. 43-55).
- [22]. Baker, R. S., & Inventado, P. S. (2014). 'Educational data mining and learning analytics'. In J. A. Larusson & B. White (Eds.), *Learning Analytics* (pp. 61-75). New York: Springer.
- [23]. Bienkowski, M., Feng, M., & Means, B. (2012). 'Enhancing Teaching and Learning Through Educational Data Mining and Learning Analytics: An Issue Brief'. Washington, DC: U.S. Department of Education, Office of Educational Technology.
- [24]. Chen, H., Chiang, R. H., & Storey, V. C. (2012). 'Business Intelligence and Analytics: From Big Data to Big Impact'. *MIS Quarterly*, 36(4), 1165-1188.
- [25]. Yiu, C. (2012). 'The big data opportunity: Making government faster, smarter and more personal'. Policy Exchange.
- [26]. Agasisti T., de Witte K. & Rogge N. (forthcoming). 'Big data and its use in the measurement of public organizations' performance and efficiency: state-of-the-art and perspectives'. *Public Policy and Administration*.
- [27]. Raghupathi, W., & Raghupathi, V. (2014). 'Big data analytics in healthcare: promise and potential'. *Health Information Science and Systems*, 2(1), 3.
- [28]. Harsha Aturupane, Paul Glewwe, Renato Ravina, Upul Sonnadara & Suzanne Wisniewski (2014) An Assessment of the Impacts of Sri Lanka's Programme for School Improvement and School Report Card Programme on Students' Academic Progress.