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Statistical Approach to Analyze Student Learning Outcomes

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Abstract: ***to improve students' learning outcomes (SLO's), it requires efforts on many aspects, out of which effective learning techniques helps and motivate students to achieve their learning goals. Learning conditions depends on prior knowledge, learning environments and the nature of the area in which the techniques are implemented. There are certain rubrics which have been decided to measure SLO's. To achieve the target, it is important to meet the introduced methodology in all respect of Course Learning Outcomes(CLO's) in National Qualification Framework (NQF) Domains of Learning and Alignment with Assessment Methods and Teaching Strategies: Knowledge, Cognitive Skills, Interpersonal Skills & Responsibility, Communication, Information Technology, Numerical and Psycho-motor.***

Index Terms: National Qualification Framework (NQF), Course Learning Outcomes (CLO's), Students Learning outcomes (SLO's).

I. INTRODUCTION

Introduced Statistical examination analysis approaches have used some useful statistical tools to analyze and compare the understanding level of students in similar nature of courses. To apply this process, there are certain steps are required to proceed in excel documents and these are: (i) to update excel document with student's internal and external marks of different courses to compute the total marks. (ii) Update the grade column accordingly. Once the marks entry process will be finished then required to apply the statistical approach to compute the required statistical parameters and these are: Mean Value, Std. Deviation, Skewness, Correlation between internal marks and external marks, minimum value and maximum value. Once these computation will be over then move to the marks distribution worksheet. Update the COUNTIF formula in frequency column according to the new dataset, the introduced statistical examination analysis is also applicable for multi courses. Repeat the introduced approach for all different courses. In case of only two courses, apply t-test and update total marks corresponding to the new dataset and go to the data excel menu ◊ Data Analysis, In the dialogue box, choose t-Test: Two Sample Assuming Unequal Variances and in the input field then choose variable range corresponding to total marks per course, keep a value 0.05 and select one cell for the output range. In case of more than two courses, go to ANOVA worksheet and update total mark (100%) corresponding to the new dataset which have been introduce by [7] Kwaku F. Darkwah, Two-way ANOVA for the Study of Revenue Mobilization Inequalities. Its application by [6] Tomasz NIEDOBA, Application of Anova in mineral Processing.

The above approach's reflects in our introduced approach. Then go the data excel menu ◊ Data Analysis. In the dialog box, choose Anova: Single Factor. In the input field- select total mark corresponding to all courses as input variable range and Keep 5% and select one cell for output display. Idea behind our proposed approach is to improve SLO's. The statistical approach will give comparative study between same nature of subject of different fields i.e the feedback of course coordinators, which makes better strategies to improve the required fields.

II. LEARNING OUTCOMES

A. Course Learning Outcomes

Method for accessing SLO's [3], As per survey of Dr. Jennifer E. R. Methods for Assessing Student Learning Outcomes, the assessment and evaluation of learning outcomes have been explained by [9],[11]. But the approach of the CLO's explained what learners will know and be able to do at the completion of the courses. It is the expected learning for the course from the expected learning for the program i.e Program Learning Outcomes (PLO's). Program outcomes are the standard units on which the outcomes of the course learning to be met, the CLO's from all the courses in the program lead to the achievement of the PLO's. Before going to design any courses, it is important to know how this course will relate with the other courses to help learners achieve the PLO's. In table 1 Mapping of CLO's with the PLO's have been designed which is suitable to help the course within the broader program of study. Learning activities are designed and organized to help learners achieve the CLO's which provide anchor for course design. Different assessment methods and its criteria have been introduced to link directly to the CLO's. In assessment activities, learners demonstrate their achievement of CLO's.

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Table 1 Mapping of CLO'S with PLO'S

Map course LOs with the program LOs. (Place course LO #s in the left column and Student LO #s across the top.)										
Course LOs # ▼	Student Learning Outcomes▼									
	a	b	c	d	e	f	g	h	i	j
. .										

B. Course Learning Outcomes

A Key Performance Indicator (KPI) is a measurable value that demonstrates how effectively Organizations use to evaluate their success at reaching targets. It provides a way to measure how everyone performing in relation to their goals and objectives and it is also a way to get the most important performance that enable organizations, whether it is on track towards its course description. Objectives have been discussed in a case study of KPI in scientific research of middle east university [4] , KPI is a decision making tool to reduces the complexity and manage the key indicators which ultimately helps faculty members to improve the result performance, so all KPI's should be strategic and meaningful.

C. Rubrics

Rubrics is an evaluation tool and guidelines to improve the expectation of learning, learning standards and learning objectives. It is a scale to define academic expectation for the students and help them for self-evaluation. It ensure the consistency in the academic works from course to course or assignments to assignments. It is also a scoring instrument to find out the grades or the award in which learning standard have been demonstrated or attained by students. Once the course going to start, it is important to introduce the rubrics to students which helps to prepare accordingly that ensure learning expectations. It supports them to improve their learning abilities, it is important to meet the expected standard as explained in course description and its learning objectives. In some course, as there learning objective have been defined for presentation of rubrics that establish the criteria to include the main description of character. The main purpose to introduce this evaluation tool to make the student confident to speak clearly and perform better to achieve good grade.

III. SLO'S MEASUREMENTS

NILOA (The National Institute for Learning Outcomes Assessment, 2015) has measured the quality in higher education, similarly the approach which we have introduced have applied over the courses to categorize according to their nature for the measurement[1]. As per nature of the courses, each and every faculty members need to measure the learning outcomes. KPI's have to measure for defined courses of different levels (Satisfactory, Developing and Unsatisfactory), Each and every faculty members need to follow the following steps to apply the introduced mathematical approach over excel works to analyze the result. Format of cells should not be changed, they need to fill data in the sheet named 'Assessment Criteria' and the ones named as 'Result - -----' Even in the sheets they need to fill, you just need to fill up only the required parts. In Assessment Criteria, write the Assessment method and the criteria you used, give a one line description and do not provide the details. In Result sheet, fill the table provided in the bottom using the level 1 (Unsatisfactory), 3 (Developing) and 5 (Satisfactory), remove the provided data and fill in your own. Do not delete any rows. Moreover, provide the name of the attached files for the evidence in attachment courses of the sheet. The attachment should be named as AY<Academic Year>_ <Course Code>_<Section Code>_<Assessment Method>. For example, AY2017-18_ α1 _S1_FinalExam. You can use any assessment method for the measurement. In some cases, it could even be faculty observation. Example: For KPI Demonstrate competence in Grammar Skills, if you opt measuring the KPI from the project presentation, you could mention the following as assessment method and criteria. In project presentation, examiners observe during the oral presentation. In that case, the copies of assessment sheet where the marks were awarded by the examiner could be used as evidence. In case, where KPI is being measured by the faculty observation during the class. You do not need to provide any evidence/attachment. The following Tables (table 2 and table 3) which have been defined below are showing KPI's with different levels and outcomes of rubrics.

Table 2 KPI'S of Different Levels

KPI ▼	Level ► KPI▼	Level-5: Satisfactory	Level-3: Developing	Level-1: Unsatisfactory
a1	Demonstrates understanding of computing and mathematics concepts required for information systems			
a2	List current applications in information systems domain			
a3	Recall data modeling, management and analysis concepts			
a4	Recognize contemporary issues in information systems domain			
b1	Identify business problems/opportunities and analyze them			
b2	List down the requirements			
b3	Create a mapping of the organizational needs to information systems domain			
b4	Determine appropriate resources needed to solve problems			
b5	Outline strategies for solving problems			
c1	Develop a design strategy			
c2	Produce effective design using modeling techniques & tools			
c3	Evaluate practical significance of design outcome			
c4	Develop a program or application to meet required objectives			
d1	Show willingness to cooperate and encourage participation among team members			
d2	Share credit of success			
d3	Justify designated role in a group			

e1	Participate in class discussions and exercises on ethics and professionalism
e2	Demonstrate ethical behavior among peers and faculty
e3	Show personal responsibility for his/her actions
e4	Demonstrate awareness of info. security concepts and issues
f1	Articulate ideas
f2	Organize written materials in effective way
f3	Demonstrate competence in grammar and spelling
f4	Illustrate ideas using effective visual aides
g1	Justify adoption of computing in societal, organizational context
g2	Evaluate the impact of adopted technologies.
g3	Analyze financial, technical and social impact of information systems on an organization
h1	Adopts professional practices and behavior in completing the given tasks and assignments
h2	Demonstrate awareness of current trends and events
h3	Demonstrate willingness to learn & research technologies
i1	Choose appropriate tools
i2	Understand various development techniques/methodologies
i3	Evaluate the usefulness of proposed development technique/methodology
i4	Appraise the limitations of development tools & techniques
j1	Understands the working of tools used in information systems environment
j2	Plans the delivery of a proposed system
j3	Manage the configuration and\or maintenance of an information system or related software

Table 3 Rubric Outcomes

a - An ability to apply knowledge of computing and mathematics appropriate to the information systems discipline.
b - An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
c - An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs
d - An ability to function effectively on teams to accomplish a common goal.
e - An understanding of professional, ethical, legal, security and social issues and responsibilities.
f - An ability to communicate effectively with a range of audiences.
g - An ability to analyze the local and global impact of computing on individuals, organizations, and society.
h - Recognition of the need for and an ability to engage in continuing professional development
i - An ability to use current techniques, skills, and tools necessary for computing practice.
j - An understanding of and an ability to support the use, delivery, and management of information systems within an Information Systems environment.

A. Considered Courses

There are twenty two courses have been considered for the course, out of which the courses have been grouped with their natures in different semester. According to the course description and the objective of the courses, these have been categorized to measure the KPI's of years 2016-17 & 2017-18 with their respective LO's.

Table 4 Course distribution for measuring SLO's 2016-2017

Academic Year▶				2016-17	
SLO ▼	Measurable KPIs▼	Semester▶		Semester Wise courses	
				Semester-2	Semester-1
a	a1 – a4	Teaching Strategies	Assessment method	$\alpha_1, \alpha_2, \alpha_3$	$\alpha_5, \alpha_{17}, \alpha_{16}$
b	b1 - b5			$\alpha_4, \alpha_5, \alpha_6$	α_7, α_8
c	c1 – c6			$\alpha_7, \alpha_8, \alpha_6$	$\alpha_1, \alpha_4, \alpha_{10}$
d	d1 – d6			$\alpha_1, \alpha_7, \alpha_{10}$	α_6, α_{11}
e	e1 – e4			$\alpha_8, \alpha_{11}, \alpha_{10}$	α_{16}, α_{18}
f	f1 – f6			$\alpha_{21}, \alpha_6,$	α_4, α_{10}
g	g1 – g3			$\alpha_{20}, \alpha_{16}, \alpha_{14}$	α_5, α_8
h	h1 – h3			$\alpha_5, \alpha_{22}, \alpha_8$	α_6, α_{14}
i	i1 - i5			$\alpha_{15}, \alpha_3, \alpha_{16}$	α_{19}, α_{20}
j	j1 – j3			$\alpha_5, \alpha_3, \alpha_2$	α_7, α_{10}

Table 5 Course distribution for measuring SLO's 2017-2018

Academic Year▶				2017-18	
SLO ▼	Measurable KPIs▼	Semester▶		Semester Wise courses	
				Semester-2	Semester-1
a	a1 – a4	Teaching Strategies	Assessment method	α1, α2, α3	α5, α17, α16
b	b1 - b5			α4, α5, α6	α7, α8
c	c1 – c6			α7, α8, α6	α1, α4, α10
d	d1 – d6			α7, α9, α10	α6, α11
e	e1 – e4			α8, α11, α10	α16, α18
f	f1 – f6			α9, α12, α11	α4, α10
g	g1 – g3			α13, α9, α14	α5, α8
h	h1 – h3			α9, α8, α12	α6, α14
i	i1 - i5			α15, α3, α16	α19, α20
j	j1 – j3			α13, α3, α2	α7, α10

B. Considered SLO'S

There are ten SLO's have been considered to measure the KPI'S of different academic years with different teaching strategies and its assessment method. The SLO's have been considered as a sample to define its respective fields and apply these fields to measure with different running course to meet the introduced methodology. table 6 has been considered as example of SLO's with sample size.

Table 6 Sample of SLO's with sample size

a-An ability to apply knowledge of computing and mathematics appropriate to the information systems discipline.						
		KPI				SLO
		a1	a2	a3	a4	
calculated average▶						
Students ID▼						
.						
Course Code▼	Sample Size▼					
α_1						
α_2						
α_3						
Calculated Weighted average▶		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Target▶		3.8	3.8	3.8	3.8	3.8
Strengths▼						
#DIV/0!						
Weaknesses▼						
#DIV/0!						
Attachments▼						

C. Course Samples of 2017-2018

Here, first three courses (α1, α2, α3) have been considered in table 7 for semester-2 of academic year (2017-18) to find out the Percentage level of courses with KPI's and its graphical representation have been shown below in Fig. 1 and Fig. 2.

Table 7 Samples 2017-2018

Course Code	Measurable KPIs	Satisfactory	Developing	Unsatisfactory
$\alpha_{1\ to}\ \alpha_3$	a1 to a4	#DIV/0!	#DIV/0!	#DIV/0!

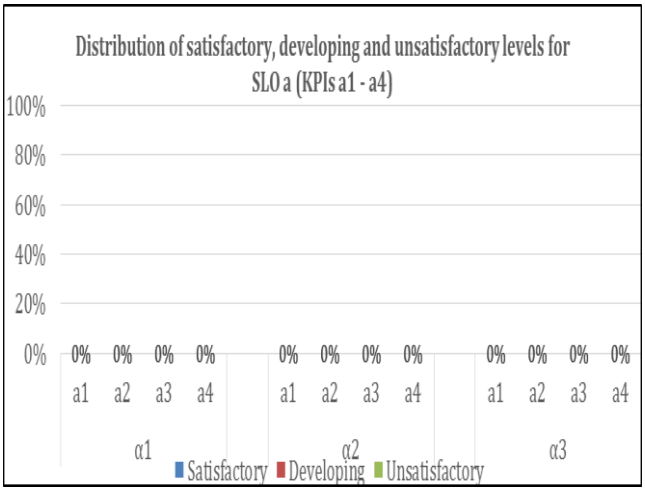

Figure 1Graphical representation of Sample's with KPI's

Table 8 SLO samples with KPI'S

Course Code	Measurable KPIs	SLO's
$\alpha_{1\ to}\ \alpha_3$	a1 to a4	#VALUE!

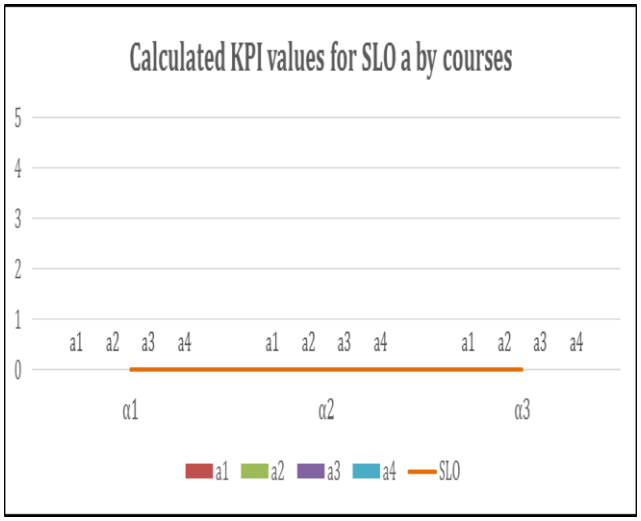

Figure 2 SLO Samples with KPI's

IV. ASSESSMENT METHOD AND CRITERIA OF SLO'S

The following tables and its respective graphical representations which are defined below have been implemented based on introduced methodology.

Table 9 Assessment method and criteria of SLO's

Assessment method and criteria of SLO's a			
KPI's▼	α_1	α_2	α_3
a1	Mid-1	Assignment	Final Exam
a2	Assignment	Quiz	-
a3	Mid-2	-	-
a4	-	Final Exam	Case Study based Assignments

Table 10 SLO's of courses with sample size

a-An ability to apply knowledge of computing and mathematics appropriate to the information systems discipline.						
KPI▶		a1	a2	a3	a4	SLO
Calculated Average▶		3.77	4.08	3.92	-	3.92
Students ID▼		Levels(1,3,5)▼				
Students I1 to I13		5,3,1, 3,5,3, 5,5,5, 3,1,5, 5	3,5,1, 5,1,5, 5,5,3, 5,5,5, 5	5,3,5, 3,5,3, 1,5,3, 5,3,5, 5	-	4.33,3.67, 2.33,3.67, 3.67,3.67, 3.67,5, 3.67, 4.33,3, 5,5
Course Code	Sample Size (n) ▼	a1	a2	a3	a4	SLO

α_1	13	3.77	4.08	3.92	-	3.92
α_2	20	3.6	4.1	-	3.6	3.77
α_3	52	3.92	-	-	4.96	4.44
Calculated Weighted Average▶		3.82	4.09	3.92	4.58	4.2
Target▶		3.8	3.8	3.8	3.8	3.8
Strengths▼						
Demonstrates understanding of computing and mathematics concepts required for information systems						
List current applications in information systems domain						
Recall data modeling, management and analysis concepts						
Recognize contemporary issues in information systems domain						
Weaknesses▼						
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Attachments▼						
AY2017_18_IS_Sem1_ISM222_1053_MidI.pdf						
AY2017_18 _IS_Sem1_ISM363_1053_AssignmentI.pdf						
AY2017_18_IS_Sem1_ISM383_1053_MidExamII.pdf						

Table 11 Percentage level of courses with KPI's

Course ▼	KPI's▼	Satisfactory	Developing	Unsatisfactory
α_1	a1	54%	31%	15%
	a2	69%	15%	15%
	a3	54%	38%	8%
	a4			
α_2	a1	30%	70%	0%
	a2	65%	25%	10%
	a3			
	a4	40%	50%	10%
α_3	a1	63%	19%	17%
	a2			
	a3			
	a4	98%	2%	0%

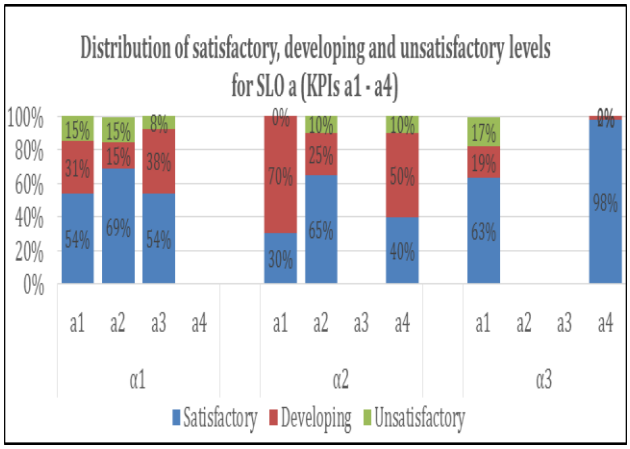

Figure 3Graphical Representation with KPI's

Table 12SLO's of courses with KPI's

Course Code▼	SLO▶	a1	a2	a3	a4
α_1	3.92	3.77	4.08	3.92	-
α_2	3.77	3.6	4.1	-	3.6
α_3	4.44	3.92	-	-	4.96

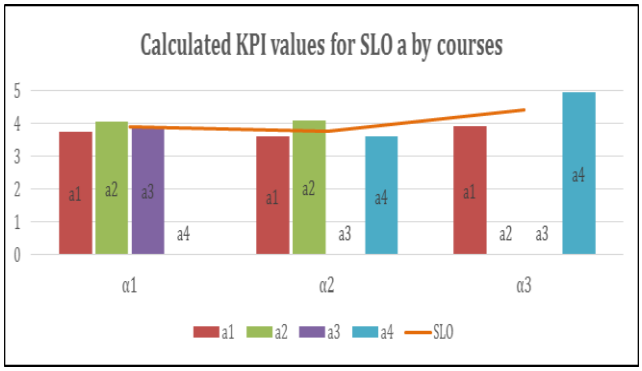

Figure 4 Graphical Representation of calculated KPI's

For statistical analysis, marks of courses which have been defined in table 13.

Table 13 Internal and External Marks of Courses

Course Code: α_1			
Internal (50%) x_i	External (50%) y_i	Total (100%) X_i	Grade
36	37	73	C
30	32	62	D
35	36	71	C
33	32	65	D
39	32	71	C
39	34	73	C
38	38	76	C
46	31	77	C
36	29	65	D
45	36	81	B
42	23	65	D
26	39	65	D
31	34	65	D
46	45	91	A
Course Code: α_2			
Internal (50%)x_i	External (50%)y_i	Total (100%) X_i	Grade
37	44	81	B
34	42	76	C
40	49	89	B
27	46	73	C
47	50	97	A
42	49	91	A
41	47	88	B
30	47	77	C
27	44	71	C
27	39	66	D
37	48	85	B
31	34	65	D
43	50	93	A

Course Code: α_3			
Internal (50%)x_i	External (50%)y_i	Total (100%) X_i	Grade
37	45	82	B
35	42	77	C
41	49	90	C
28	46	74	C
47	50	97	A
42	49	91	A
42	48	90	A
30	47	77	C
27	44	71	C
27	39	66	D
37	47	84	C
31	34	65	D
43	50	93	A

V. ANALYSIS

Statistical analysis is a component of data analytics. It is a process to examine data sets for concluding the information which they contain. It involves collecting and scrutinizing every data samples in a set of items from which samples can be drawn. Statistical analysis describes the nature of the data to be analyzed. It can also create a model to summarize that how the data relates to prove (or disprove) the validity of the model and its goal is to identify the trends. Some important methods for statistical data analysis are- Mean, Std. Deviation, Skewness, Correlation and some other methods are to analyze the data.

In introduced approach, we have used different statistical tools to analyze the approach. These are for two courses or more than two courses, t-test: Two sample assuming unequal variances and have been introduced for two courses and Anova: single factor for more than two courses.

Mean: The arithmetic mean, more commonly known as “the average,” is the sum of a list of numbers divided by the number of items on the list. The mean is useful in determining the overall trend of a data set or providing a rapid snapshot of your data. Another advantage of the mean is that it’s very easy and quick to calculate.

μ =x_bar= (Σ Xi) / n, The symbol ‘μ’ represents the average or mean, The symbol ‘Σ Xi’ represents the sum of all scores and The symbol ‘n’ represents the total number of individuals.

Standard Deviation: The standard deviation, often represented with the Greek letter sigma, is the measure of a spread of data around the mean. A high standard deviation signifies that data is spread more widely from the mean, where a low standard deviation signals that more data align with the mean. In a portfolio of data analysis methods, the standard deviation is useful for quickly determining dispersion of data points.

σ = sqrt[Σ (Xi – μ)2 / n], The symbol ‘σ’ represents the standard deviation and The term ‘Σ (Xi – μ)2’ used in the formula to represents the sum of the squared deviations of the scores from their mean.

Skewness: it is a measure of the asymmetry of the probability distribution of a real-valued random variable about its mean. The skewness value can be positive or negative, or undefined. It can be quantified to define the extent to which a distribution differs from a normal distribution.

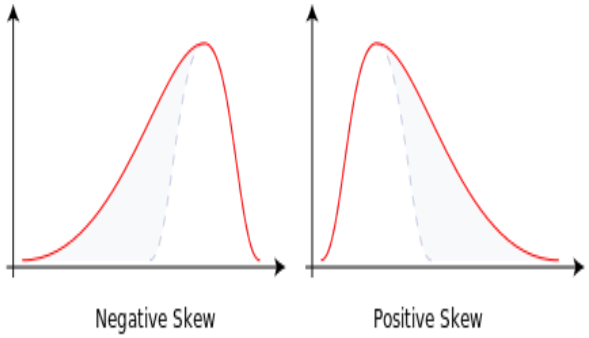

Figure 5 Graphical Representation with KPI’s

In a normal distribution, the graph appears as a classical, symmetrical "bell-shaped curve." The average or maximum point on the curve is equal.

$$S = \frac{1}{n}\frac{\sum_{i=1}^{n}(X_i - X_{avg})^3}{\sigma^3}$$

Where, S and n are skewness and sample size

Sample skewness formula

$$S = \frac{n\sqrt{n}}{n}\frac{\sum_{i=1}^{n}(X_i - X_{avg})^3}{(\sum_{i=1}^{n}(X_i - X_{avg})^2)^{3/2}}$$

Population skewness formula

$$S = \sqrt{n}\frac{\sum_{i=1}^{n}(X_i - X_{avg})^3}{(\sum_{i=1}^{n}(X_i - X_{avg})^2)^{3/2}}$$

Negative Skewness: When a distribution is skewed to the left, the tail on the curve's left-hand side is longer than the tail on the right-hand side, and the mean is less than the mode.

Positive skewness: When a distribution is skewed to the right, the tail on the curve's right-hand side is longer than the tail on the left-hand side, and the mean is greater than the mode.

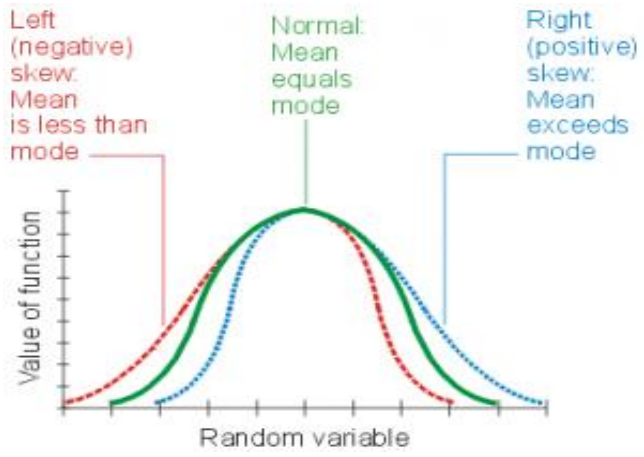

Figure 6 Random variables with its Functional values

Correlation: Correlation is a statistical technique that can show(fig 6) whether and how strongly pairs of variables are related, it is useful when we want to look at the relationship between two variables while removing the effect of one or two other variables, correlation is only appropriate for certain kinds of data. **Correlation works for quantifiable data,** an intelligent correlation analysis can lead to a greater understanding of data.

The strength of the linear association between two variables is quantified by the correlation coefficient. Given a set of observations $(x_1, y_1), (x_2,y_2),...(x_n,y_n)$, the formula for computing the correlation coefficient is given by s_x and s_y are the sample standard deviation.

$$r = \frac{1}{n-1}\sum\left(\frac{x-\overline{x}}{s_x}\right)\left(\frac{y-\overline{y}}{s_y}\right)$$

Pearson's Correlation Coefficients

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Population correlation coefficient

$$\rho_{xy} = \frac{\sigma_{xy}}{\sigma_x \sigma_y}$$

Where σ_{xy} as the population covariance, σ_x and σ_y as the population standard deviations Formula for mean x_i

$$\mu_x = (\sum x_i)/n$$

Formula to find the sample mean of x

$$\mu_y = (\sum y_i)/n$$

Formula to find the sample standard deviation of x

$$\sigma_x = \sqrt{\frac{\sum_{i=0}^{n}(x_i - \mu_x)^2}{n-1}}$$

Formula to find the sample standard deviation of x

$$\sigma_y = \sqrt{\frac{\sum_{i=0}^{n}(y_i - \mu_y)^2}{n-1}}$$

Formula to find Pearson correlation coefficient

$$\rho_{x,y} = \frac{\sum_{i=1}^{n}(x_i - \mu_x)(y_i - \mu_y)}{(n-1)\sigma_x \sigma_y}$$

Where, μ_x , μ_y are the sample mean and σ_x, σ_y are the standard deviation for data sets x_i and y_i

The correlation coefficient always takes a value between -1 and 1, with 1 or -1 indicating perfect correlation (all points would lie along a straight line in this case). A positive correlation indicates a positive association between the variables (increasing values in one variable correspond to increasing values in the other variable), while a negative correlation indicates a negative association between the variables (increasing values is one variable correspond to decreasing values in the other variable). A correlation value close to 0 indicates no association between the variables(fig 7).

- 1 indicates a strong positive relationship.
- -1 indicates a strong negative relationship.
- A result of zero indicates no relationship at all.

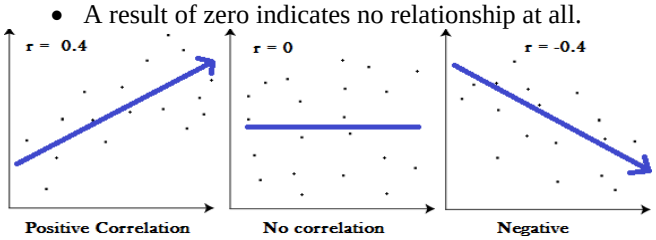

Figure 7 Correlation Representations

All the above defined formulas are already built and developed in excel, as we introduced the methodology that going to relate with statistical approach of different fields to analyze the results of different courses and provide a way to improve strategies of learning outcomes which have been shown in table 14 & its respective graphical representations in below figures Fig(8), Fig(9) and Fig(10).

Table 14 Frequency, Grade and Normal distribution of courses

Course Code: α_1				
Marks Range	Grade	Frequency	Grade Dist. %	Normal Dist. %
0 - 59	F	0	0%	2%
60 - 69	D	6	43%	14%
70 - 79	C	6	43%	68%
80 - 89	B	1	7%	14%
90 - 100	A	1	7%	2%
TOTAL		14		
Course Code: α_2				
Marks Range	Grade	Frequency	Grade Dist. %	Normal Dist. %
0 - 59	F	0	0%	2%
60 - 69	D	2	14%	14%
70 - 79	C	4	29%	68%
80 - 89	B	4	29%	14%
90 - 100	A	3	21%	2%
TOTAL		13		
Course Code: α_3				
Marks Range	Grade	Frequency	Grade Dist. %	Normal Dist. %
0 - 59	F	0	0%	2%
60 - 69	D	8	57%	14%
70 - 79	C	10	71%	68%
80 - 89	B	5	36%	14%
90 - 100	A	4	29%	2%
TOTAL		27		

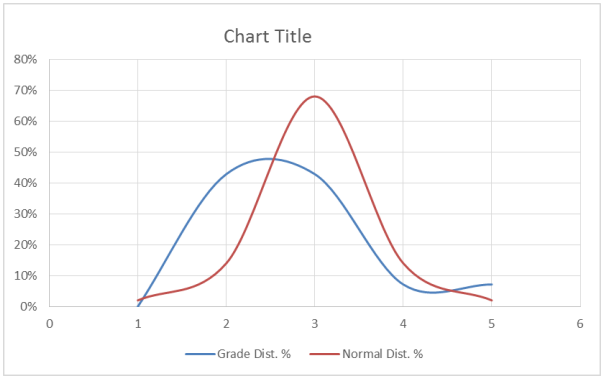

Figure 8Graphical Representation of Course 1

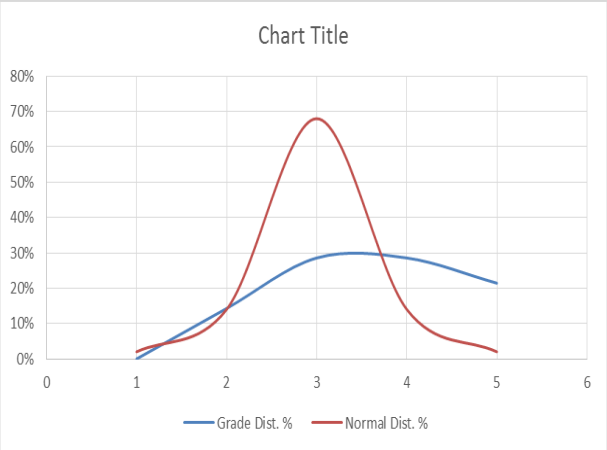

Figure 9 Graphical Representation of Course 2

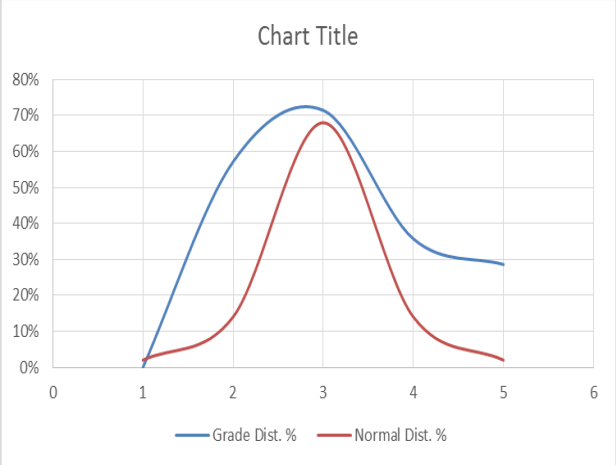

Figure 10 Graphical Representation of Course 3

T-test of first two courses (table XV) and its respective results in table 16.

Table 15 Frequency, Grade and Normal distribution of courses

Examination Results Analysis Report and Statistical Parameters for courses					
College	Dept	Courses		Test Type	Test Score
Parameter		α_1	α_2	T -Test	cumulative value of α_1 & α_2
Mean		71.43	80.92		76.00
Std. Deviation		7.98	10.47		10.28
Skewness		1.15	-1.10		0.52
Corre lation	sem & final	0.095	0.64		0.10
Minimum		62.00	65.00		62.00
Maximum		91.00	97.00		97.00

T-test: Two-Sample Assuming Unequal Variances - This tool executes a two-sample student's t-Test on data sets from two independent populations with unequal variances. This test can be either two-tailed or one-tailed contingent upon if we are testing that the two variables means are different or if one is greater than the other.

Table 16 Statistical Parameter for Comparing Students score of Two Courses

t-Test: Two-Sample Assuming Unequal Variances		
Variables=>	Variable 1	Variable2
Mean	71.4285714	80.92308
Variance	63.6483516	109.5769
Observations	14	13
Hypothesized Mean Difference	0	
df	22	
t Stat	-2.63580674	
P(T<=t) one-tail	0.00754814	
t Critical one-tail	1.71714437	
P(T<=t) two-tail	0.01509627	
t Critical two-tail	2.07387307	

Similarly Statistical Parameters for Compare of more than two curses Students' Scores which required applying Anova: Single factor approach to select the total marks in the input field corresponding to all courses as input variable range and select one cell for the output display.

Anova: Single Factor- The one way analysis of variance (ANOVA) is used to determine whether there are any statistically significant differences between the means of three or more independent (unrelated) groups. The one-way ANOVA compares the means between the groups you are interested in and determines whether any of those means are statistically significantly different from each other. Specifically, it tests the null hypothesis:

$$H_O: \mu_1 = \mu_2 = \mu_3 = \cdots = \mu_k$$

Where μ = group mean and k = number of groups

After applying the Anova: single factor test to find the result of different statistical fields.

VI. CONCLUSION

To achieve the objective and goals of the course, it is important to introduce, summarize the effective and successful course description which gives the logical overview of course and explain how courses fits into the fields for the each level and group, Students should be aware of learning objectives and outcomes of the course, teaching philosophy of faculty and the mission of the department are also an active part of course description, contents and its order of the course in which syllabus have to cover with method of assessment in which to integrate the course. The following above introduced points are important, for justification, our introduced methodologies which integrate learning outcomes and its statistical approach to improve the teaching and learning process which are useful for both students to get motivated to perform as good as possible and faculty to award them justified grade.

REFERENCES

1. NILOA (The National Institute for Learning Outcomes Assessment, 2015). Measuring Quality in Higher Education: An Inventory of Instruments, Tools and Resources. 2015-12-12.
2. Jianxin Zhang, Research on the Assessment of Student Learning Outcomes, 2017 Council for Higher Education Accreditation/CHEA International Quality Group.
3. Dr. Jennifer E. R. "Methods for Assessing Student Learning Outcomes," Coordinator of Academic Assessment Office of Institutional Research, Planning, and Assessment Northern Virginia Community College 2008.
4. Yusuf A. Al-Turki, Anwar L. Bilgrami, "A case study of key performance indicators in scienctific research in a middle eastern university, International journal of latest research in science and technology. Volume 4, issue 6: Page No.21-28, Nov-Dec 2015
5. Dick M. Carpenter II Æ Lindy Crawford Æ Ron Walden, "Testing the efficacy of team teaching" Springer Science+Business Media B.V. 2007, Learning Environ Res (2007) 10:53–65 DOI 10.1007/s10984-007-9019.
6. Tomasz NIEDOBA* , Paulina PIĘTA, "Application of Anova in mineral Processing" Mining Science, vol. 23, 2016, 43−54, ISSN 2084-4735
7. Kwaku F. Darkwah, Richard Tawiah1 , Maxwell Adu-Gyamfi, "Two-way ANOVA for the Study of Revenue Mobilization Inequalities" Lithuanian Statistical Association, Statistics Lithuania Lietuvos statistikų sąjunga, Lietuvos statistikos departamentas ISSN 2029-7262, 2015, vol. 54, No 1, pp. 45–51 2015, 54 t., Nr. 1, 45–51 p,
8. Jean Ashby," Comparing student success between developmental math courses offered online, blended, and face-to-face" Volume 10, Number 3, Winter 2011 ISSN: 1541-4914, Journal of Interactive Online Learning
9. Ramona Lile, Camelia Bran CESC 2013, "The assessment of learning outcomes", Procedia - Social and Behavioral Sciences 163 (2014) 125 – 131. Published by Elsevier Ltd.
10. Berger, J. B., & Milem, J. F. (1999). The role of student involvement and perceptions of integration in a causal model of student persistence. Research in Higher Education, 40, 641–664.
11. Sylvia Encheva, Evaluation of Learning Outcomes, ICWL 2010: Advances in Web-Based Learning – ICWL 2010 pp 72-80. SpringerLink

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