

Value the Formative Assessment, for it Values the Student Outcome - A Historic Cohort Study of Dental Undergraduate Students in India

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Abstract—Background of the study: There are several researches on assessment but very few evidence is available in finding the association between the formative and the summative assessment especially in higher education like health sciences. The aim of this study was to determine the relationship between the formative and summative performance of the dental undergraduate students retrospectively. **Methodology:** The theory marks of the first year BDS students of three consecutive years (Batch A, B and C) in the initial formative assessment and final summative assessment were collected retrospectively. The total theory marks of the students in both the assessments were analysed statistically using Pearson Correlation analysis. **Results:** The data analysis showed significant positive association (2013-14 – 62%, 2014-15 – 71%, 2015-16 – 65%) between the formative and summative assessment performance of all three batches. **Conclusion:** The performance in formative and summative assessments have good positive correlation suggesting that formative assessment results should be treated with more value for better student outcome.

Index Terms—dental students, Formative assessment, summative assessment, Student outcome

I. INTRODUCTION

The education is an open system in which the input, process and output influences each other. The success of the system is tested by the assessment of students in the process phase. “Ref. [1], [2]” Assessment drives the learning process and plays a vital role in the educational system. “Ref. [3]” Assessment is considered as an educational tool itself and is proved to be more effective than the meticulously planned innovative instructional strategies for improving the students’ learning process. “Ref. [4]” AAHE principles of good practice for student learning states that for the assessment to be useful, the information gathered from it needs to be related to all the stakeholders concern as an evidence for corrective measure. “Ref. [4], [5]” If properly utilised, it aids in continuous improvement. Based on the timeline of occurrence in the educational cycle, it can be an assessment for learning (formative), assessment as

learning (metacognition) and assessment of learning (summative).

“Ref. [6]” The formative assessments are primarily used to improve the instructional strategies and provide feedback to the students on their performance. The role of teachers is often overemphasized in the summative assessment and grading. “Ref. [7]” The perception of the teachers of health sciences is also not an exclusion. “Ref. [5], [6]” However more attention is needed in the formative assessments the diagnostic aspect of which needs to be utilized and keep the students informed on their status.

“Ref. [8]” Though both the formative and summative assessments recognise the deficiencies, the summative assessment has the drawback of leading to academic penalty. In spite of the provision for an additional exam, the students are in great stress during the remedial process. Formative assessments render more benefits in this concern. However, there lied an opinion that the formative assessments and the corrective feedbacks are of no use and are just waste of time till some years. “Ref. [9], [10]” But studies have proved that the students’ perception reveals extreme positivity in the usefulness of the formative assessments.

“Ref. [8]” Rolfe et al (the Lancet, 1995) expressed the need for more research in formative assessments. “Ref. [11]-[13]” Other authors also have reported on the lack of enough evidence and the need for research on the various perspectives of formative assessments. “Ref. [12]” Among them, the researches on the prognostic abilities of the formative assessment, its correlation with the summative assessment was also reported to be rare. “Ref. [14], [15]” One of the five criteria of an assessment as proposed by Van Der Vleuten is educational impact. The prognostic ability increases the educational impact of the formative assessment.

This study aimed to correlate the formative and summative assessments, “Ref. [16]” acknowledging the scarcity of evidence in this topic in health sciences to create an evidence thus contributing to the concept of Best Evidence Medical Education by Harden.

II. METHODOLOGY

The study was done with the clearance from Institutional review board and Institutional Ethical

Committee. The first formative assessment and the final summative assessment (University exam) theory marks of three consecutive batches (2013-14, 2014-15 and 2015-16) of first year BDS students were collected retrospectively in a private dental college in India. The first formative assessment included approximately 30% of the total content in all the four subjects namely Anatomy, Physiology, Biochemistry and Oral anatomy. The conduct of the formative and the summative assessments were identical in all aspects. The question paper format had long answer question, short answer questions and very short answer questions in two sections for a total of 70 marks. The written examination time duration was three hours for both the exams and the marks utilised for computing statistics does not include any internal or practical or viva voce marks.

The data of the students who attended all the papers in both exams alone were included. 2013-14 batch comprised of 93 students, 2014-15 batch comprised of 94 students and 2015-16 batch comprised of 93 students respectively. The data had the students' theory marks in Anatomy, Physiology, Biochemistry and Oral histology. The total marks of all four subjects in the first formative assessment and summative assessment (University exam) were used for data analysis. All the three batches were analysed individually.

Data analysis was done using Pearson correlation test along with descriptive statistics in order to study the correlation between the first formative assessment and the summative assessment in each batch. The results were tabulated and scatter plot was done for each batch.

III. RESULTS

The statistical analysis revealed positive correlation between the first formative assessment and the summative assessment in all the three batches. The descriptive statistics (Table I) and the Pearson correlation coefficient was computed for 2013-14 batch (Table II) and the results revealed a positive correlation between the two variables, $r = 0.790$, $n = 93$, $p < 0.001$. "Fig. 1," scatterplot summarizes the results and the r^2 value is 0.623 suggesting 62% positive correlation between the first formative and the summative assessment.

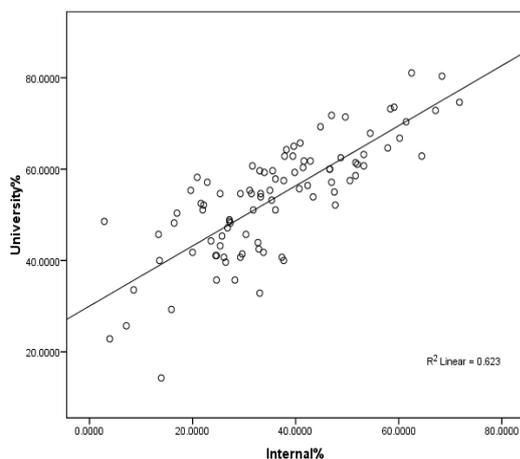


Figure 1. Scatter plot 2013-14

TABLE I: DESCRIPTIVE STATISTICS 2013-14

	Mean	Std. Deviation	N
Internal%	35.883257	14.9442167	93
University%	53.648233	12.4556500	93

TABLE II: CORRELATIONS 2013-14

		Internal%	University%
Internal%	Pearson Correlation	1	.790**
	Sig. (2-tailed)		.000
	N	93	93
University%	Pearson Correlation	.790**	1
	Sig. (2-tailed)	.000	
	N	93	93

** . Correlation is significant at the 0.01 level (2-tailed).

TABLE III: DESCRIPTIVE STATISTICS 2014-15

	Mean	Std. Deviation	N
Internal%	40.968845	14.7239449	94
University%	45.782675	13.2184135	94

TABLE IV: CORRELATIONS 2014-15

		Internal%	University%
Internal%	Pearson Correlation	1	.841**
	Sig. (2-tailed)		.000
	N	94	94
University%	Pearson Correlation	.841**	1
	Sig. (2-tailed)	.000	
	N	94	94

** . Correlation is significant at the 0.01 level (2-tailed).

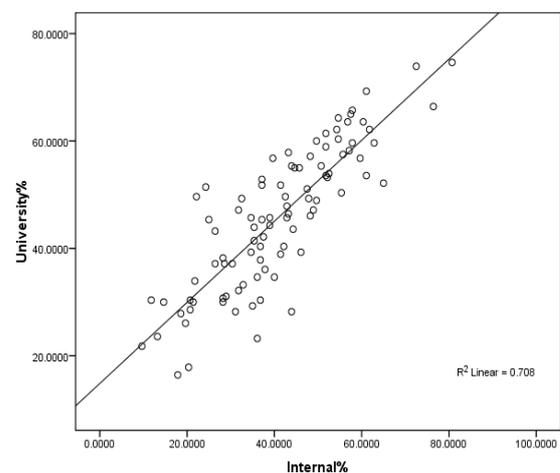


Figure 2. Scatter plot 2014-15

The descriptive statistics (Table III) and the Pearson correlation coefficient was computed for 2014-15 batch (Table IV) and the results revealed a positive correlation between the two variables, $r = 0.841$, $n = 94$, $p < 0.001$. "Fig. 2," scatterplot summarizes the results and the r^2 value is 0.708 suggesting 71% positive correlation

between the first formative and the summative assessment.

The descriptive statistics (Table V) and the Pearson correlation coefficient was computed for 2015-16 batch (Table VI) and the results revealed a positive correlation between the two variables, $r = 0.809$, $n = 93$, $p < 0.001$. “Fig. 3”, scatterplot summarizes the results and the r^2 value is 0.654 suggesting 65% positive correlation between the first formative and the summative assessment.

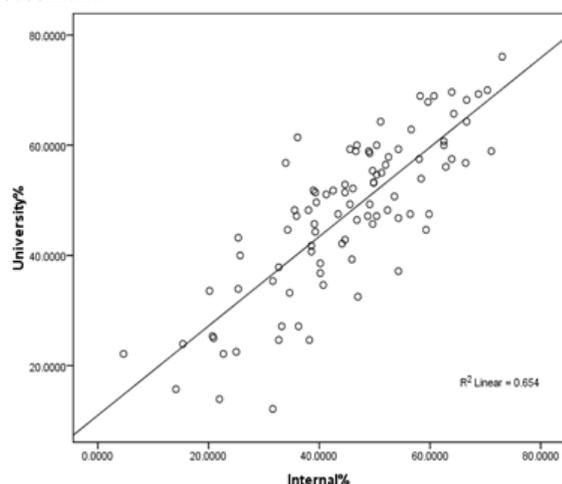


Figure 3. Scatter plot 2015-16

TABLE V: DESCRIPTIVE STATISTICS 2015-16

	Mean	Std. Deviation	N
Internal%	45.243856	14.1055159	93
University%	47.684332	14.1475866	93

TABLE VI: CORRELATIONS 2015-16

		Internal%	University%
Internal%	Pearson Correlation	1	.809**
	Sig. (2-tailed)		.000
	N	93	93
University%	Pearson Correlation	.809**	1
	Sig. (2-tailed)	.000	
	N	93	93

** . Correlation is significant at the 0.01 level (2-tailed).

IV. DISCUSSION

The correlation between the first formative assessment and the summative assessment performance were analysed statistically. The Pearson correlation coefficient(r) were 0.790, 0.841 and 0.809 for 2013-14, 2014-15 and 2015-16 batches respectively. The analysis suggests a good positive correlation between both the assessments in all the three batches.

“Ref. [17]” This study is in line with the results of Alain et al where the use of formative quiz was studied to detect the risk of failing students in anatomy. Apart from the overall correlation, the authors also reported a

stronger correlation for the students who performed poor in the formative quiz. The authors have concluded that the midterm evaluation is strongly correlated with the summative assessment whereas the current study has utilized the first formative assessment data for analysis. The benefit of the results of current study facilitates early prediction. Earlier the detection, better is the remedial measure.

“Ref. [18]” The results of the present research is also correlating with the results of Maria et al in which the association between formative assessment and the academic achievement of pre-graduate health sciences students are studied. The authors have reported a positive association between the formative and the summative assessment.

“Ref. [12]” Krasne et al reported statistically significant correlation between the mean individual score in both the assessments which is reflected in the current study. The coefficient obtained by them is $r=0.58$ where in the current study revealed comparatively higher correlation in all the three batches as already explained in the results.

“Ref. [19]” Niu Zhang et al found positive correlation with 52% positive association in the scatter plot between the formative and summative assessments. The current study also obtained a positive association of 62%, 71% and 65% in the scatter plot for the respective batches.

“Ref. [13]” Helen Anziani *et al* did not found any positive association between the formative and summative assessment unlike the current study. The possible reasons as explained by the authors were lack of identical format of both the assessments, the association was done for clinical work unlike the written exams in other studies and the anxiousness of the students for the summative assessment.

The value of formative assessment increases by multiple fold when the academic faculty recognises the potential effects of the gathered data and start working on it. “Ref. [4]-[6]” Though high or low stakes criteria of the assessment determines its importance among the students, yet the student perceives and retains any form of assessment in the forefront of learning process. The results of this study might help us to work on the “zero-failure initiative” by early identification since an adequate time period of six to eight months is available from the conduct of the first formative assessment and before the conduct of the summative assessment. Thus it’s the teacher’s responsibility to focus on the students’ performance in the formative assessments and guide the Students Needing Additional Curricular Support at the earliest to improve their outcome.

V. CONCLUSION

Within the confines of the study, it is concluded that the theory based first formative assessment has a positive correlation with the summative assessment of same nature in the first year BDS students. The percentage of positive association was found to be above 60% in all three batches. The results of the study can be utilised for the early detection of the Students Needing Additional

Curricular Support to try and improve their performance in the final examination.

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