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IMPROVING ASSESSMENT PRACTICES IN THE HIGHER EDUCATION SYSTEM: MAPPING PROGRAM OBJECTIVES WITH COURSE LEARNING OUTCOMES

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ABSTRACT

This article aims to evaluate assessment practices for the alignment between the Program objectives (PO's) that represent the role of the education system with the Course Learning Outcome (CLOs). A Statistical analysis was conducted on the content of the Learning outcome to map the Program objectives in the curricula of the Higher Education System (HES). Findings suggest that designing a curriculum for a program is a very challenging task because of coverage and depth. In this study, PO's mapping was deliberately asked among participants to accomplish the requirement of the higher education system. Results show that in some of the courses, the learning outcome is achieved based on the performance of the students. It also shows the reflection of the program objective corresponding to the learning objective. Issues and Challenges of the design assessments have been discussed in this paper. Recommendations have been suggested regarding the assessment of students, course evaluation, and the moderation process. Significance and impact of mapping program objectives with course learning outcomes. The research hypothesis is formulated, and empirical research studies are carried out. Statistical syntheses were carried out, using primary data sets, providing original interpretations.

KEYWORDS: Higher Education System, Assessment, Quality, Learning System, Moderation.

1. INTRODUCTION

Higher education systems all around the world should have the same quality of learning to bring uniformity in the process and system (Banta, T.W. (Ed)., 2002; Bers, T., 2008; Clarence, S., et.al., 2015). The desired learning outcomes of any program not only provide a certified educational qualification to the students but also provide them with the right skills needed to fulfill the market needs. The theoretical modeling of competencies, their assessment, and the use of assessment results in practice present new challenges for psychological and educational research (Shavelson, R. J., 2010; Koeppen, K., et. al., 2008). Students' assessments are the core concept that needs constant attention from educational policymakers as well as from educators. Assessment plays an important role in providing high-quality teaching and learning (Banta, T.W. 2007; Carly Steyn et al., 2019). According to the instructional design, learning intent and learning objectives will be monitored and measured in the assessment process (Clarence, S., Quinn, L., & Vorster, J. A., 2015). The assessment is defined as "the means through which educators can gauge the link between desired educational outcomes and actual student achievement" (Banta, 1999; Martell, 2007; Pittaway et al., 2009). Assessment is a "systematic process for gathering and evaluating information on students' progress, which can be used for one or more of the following three purposes: to Provide Certification, to Measure & Improve Student Learning, and to contribute to Quality Assurance.". (Tian, X.,2007; Banta, T.W., 1999). Assessment is a powerful tool in evaluating an individual student's performance and in monitoring the success of educational courses and programs in meeting their unique and stated goals. Maybe some agree to have a standardized assessment to compare the best institute, but it is unpredictable to have a common institute, benefiting a single individual (Jones, D. A., 2009). Formative assessment with feedback helps a student to become a self-regulated learner. Feedbacks provide the students' perceptions of their learning experience that helps in course design and development (David J. Nicolet et al., 2006; Carly Steyn et al., 2019). The assessment and support learning used by teachers help student for profound knowledge (David J. Nicol et.al., 2006). Online methods have also been used to evaluate learners. The drawback of this method is that fewer responses are received in an online evaluation. A test was conducted to increase the number of responses to complete the online evaluation during class time (Karen Young et. al., 2019). Online assessment may not fit the traditional methods for assessment. Thus, the unique assessment technique is still underdeveloped (Underhill, A. F., 2006). Project-based learning and problem-oriented project-based learning are other methods to assess the learner. Some of the universities are still practicing the traditional methods to assess the students. Students are no longer interested in memorizing textbooks. Many universities introduced the project in every course where more weight is given to projects. These projects are based on creative and innovative dimensions. Students will be assessed based on their performance throughout the projects as well as the final outcome of the projects (Yasin, R. M., Mustapha, R., & Zaharim, A., 2009). Portfolio and self-assessment on writing tasks are another assessment method (Khodadady, E., & Khodabakhshzade, H., 2012). Criteria-referenced is also used as self-assessment, where students are advised to collect information about their own performance or progress; compare it to explicitly stated criteria, goals, or standards; and revise accordingly. The purpose of this method is to identify areas of strength and weakness in one's work in order to make improvements and promote learning. (Heidi Andrade & Anna Valtcheva, 2009). Activity theory, as developed by Engeström, is also used as an assessment for student learning (Havnes, A., 2004). Summative assessments have also been practiced in the form of assignments and portfolios to criticize the current assessment practices. (Clarence, S., et al., 2015). A project ILLEV is developed to model and measure the cognitive dimensions of professionalism, that is, subject-specific and didactical competence in the field of business and economics (Zlatkin-Troitschanskaia, O., Fo¨ rster, M., & Kuhn, C., 2013). Effective assessment is required in conventional teaching methods as well as web-based learning. Intelligent techniques have also been used for effective assessment (I. Almrashdah, et.al., 2008; Baalsrud-Hauge, et al., 2015). Learning management system identifies the standard based requirements such as features, technical and support structure for assessment Stes, A., Min-Leliveld, M., Gijbels, D., & Van Petegem, P. (2010). As an application, the measures developed were used in the assessment of MySLULMS (G.P.C. Genove and C.A. Mercado, 2010).

2. HIGHER EDUCATION INSTITUTIONS AND ASSESSMENT PRACTICES

Every university has a mission and vision to achieve, and accordingly, the higher education institution plans its programs. Each program has

program objectives (PO's) and learning objectives (LO's) as shown in Figure 1. A conceptual relationship is established between LO's and PO's, and then metrics are collected according to the determined relationship between learning objectives and Program objectives. Consistency is achieved through the process of moderation in the assessment components at the faculty level in the higher education system. After that, data related to assessments are collected in the form of metrics, which are used as input for program review and faculty review at the university level. Figure 1 explains the university's practice for the assessments.

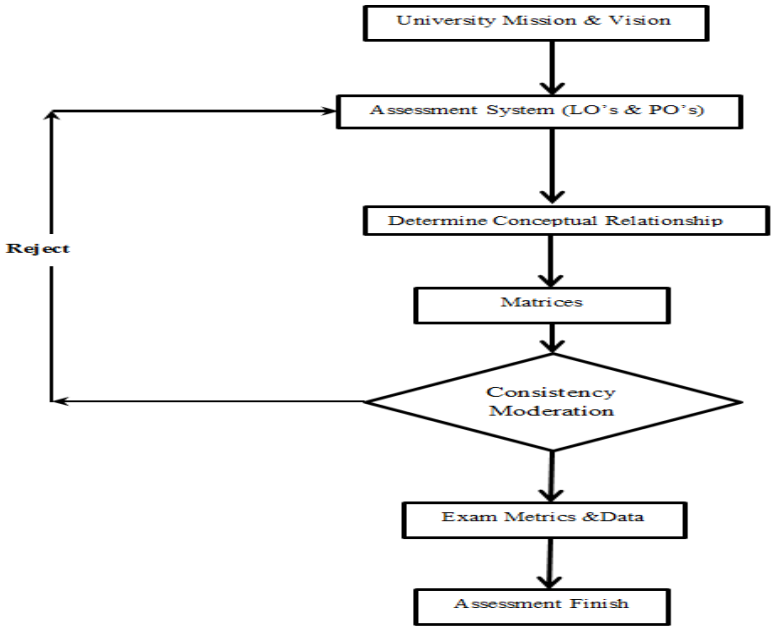

Figure 1: University Practice of Assessment.

There are many accreditations and processes that monitor the quality in the higher education system but when it comes to assessments, there is no standard mechanism. There are many ways education is measured in higher education, like lectures, tutorials, labs, and experimentation. There are many more ways, like assignments, presentations, discussions, and group activities, as illustrated in Figure 1. Higher education regulating agencies, for detailed explanations about moderation practices and process, set a benchmarking and quality agenda (Bloxham, 2009). There is a lot of challenges in "assessment drives student learning" (Ramsden, 2003). Moderation is a process of quality assurance (McDonald, 2016) that can help in solving these assessment issues to some extent.

Teaching and learning outcomes are assessed in higher education systems through students' knowledge, skills, and attitudes (Tremblay, K., Lalancette, D., & Roseveare, D., 2012). The whole higher education system is built around the concept of knowledge transfer and the methodology of knowledge transfer from the teacher to the learner.

Programs designed and offered in higher education systems are based on preparing students from unskilled to semiskilled and then extending to fully skilled learners. In the school system, students are prepared for learning and applying the concept and knowledge in troubleshooting real-world problems. Today, higher education institutions are heavily dependent on research income and students' productivity. These systems are dependent on the three main pillars, which consist of teaching, research, and services. All the teachers in the higher education system are accountable for teaching, research, and the services rendered to the society (Sam Stringfield, 1995), Darling-Hammond L., 2010)

Most of the higher education institutions design and update their curriculum according to market needs and students' employability. While designing any new program, market surveys are carried out by the universities to study the market needs so that the program does not suffer from an intake. In the higher education system, market need and content delivery has a very strong correlation with industry needs. Research needs are also merged together while designing the curriculum. Once the curriculum is decided through the proper channel, then its effectiveness is measured in the higher education systems. Programs are designed and delivered according to market needs, university vision and missions and department needs or faculty needs

(Akareem, H. S., & Hossain, S. S., 2016; Clark G. Gilbert, Michael M. Crow & Derrick Anderson, 2018)

Each program has objectives, aims, and deliverables and learning outcomes, which should be measured. All the program objectives should be matched with courses and subjects (Biggs, J. B. (2011). Each program has a delivery mode via lectures, tutorials, labs, experiments, observations etc. All the programs are delivered within a prearranged, strict time framework and a fixed calendar is followed in the delivery of the programs.

Assessments play a very important role in quantifying the extent of knowledge transferred from teacher to the learner or from expert to the learner (Gulikers, J. T., Bastiaens, T. J., & Kirschner, P. A. (2004). All the assessments are restricted to numbers like GPA, CGPA, Percentage, Divisions etc (Spooren, P., Brockx, B., & Mortelmans, D. 2013). The goals or objective of any university in the higher education system is to achieve excellence in the process of knowledge transfer. Universities and colleges focus on quality teaching through which they can achieve excellence in teaching, research and community services. Assessments are the process or mechanism of quantifying the effectiveness of any process or system. In the higher education system which starts from the ministry of higher education, university grants commissions, universities, colleges, and institutions all the assessed for effectiveness and knowledge delivery at one-point time in the system. Ministries, universities goals and objectives keep changing according to market needs and demands.

According to the ministries of higher education, governance, administrations, transparency, accountability and ethical principles which should be in place and time to time their efficiency should be measured and assessed (Prenger, R., Poortman, C. L., & Handelzalts, A. 2017). According to universities and colleges quality teaching, learning, research and community services should be delivered in a very effective manner. To achieve excellence, they need measurement and assessment on a continual basis.

3. TEACHING AND LEARNING PROCESS

Students learning experience and development in the process of learning must be given top priorities. Curriculums are continually updated and redesigned according to market needs and it is always making sure that students are given real knowledge that is needed in the market. Curriculum updating happened through the proper review process as illustrated in Figure 2 and it is assessed thoroughly for technology enhancement and market needs. Higher education delivery is done through course work or through research work (Gronlund, N.E., & Linn, R. L. 1965).

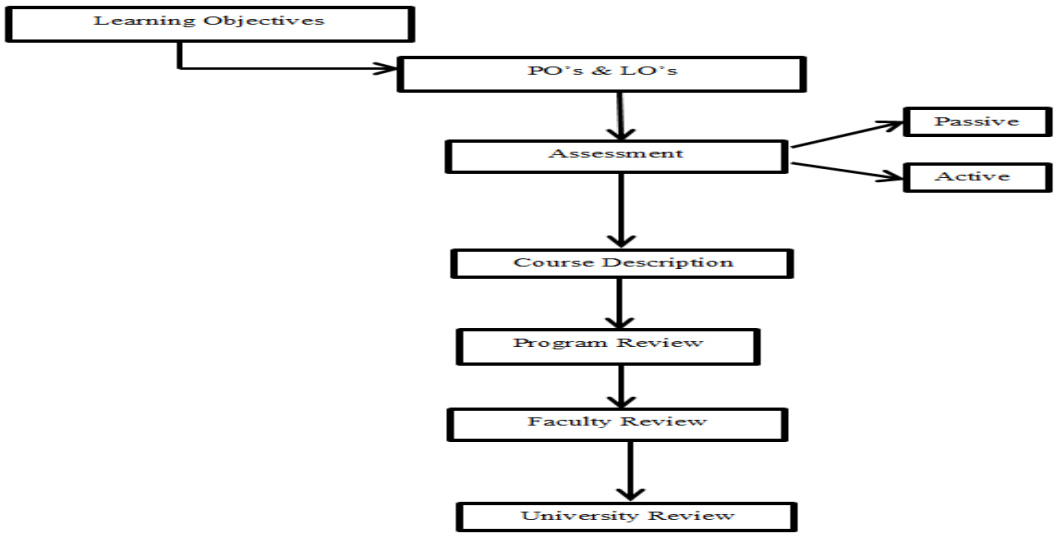

Figure 2: Teaching and Learning Review Process.

The higher education system is based on learning objectives, which is based on knowledge, the acquisition of appropriate skills for doing specific tasks, or through practice and can, therefore, be considered generic learning outcomes in the process (Ramsden, P. 2003)

Process Objectives: what, when, who, and how with specific time consumption.

Outcome objectives: Specific & concise statements that state who will make what change, by how much, where, and by when.

Impact Objectives: Tells how you will change

attitudes, knowledge, and behavior (short term). – describes the degree to which you expect this change.

Example Impact Objectives: At the end of the training, 50% of the students trained on the milling machine will be able to identify at least 3 main types of faults occurs on the milling machine and provide some types of preventive maintenance.

ROQSA defined the objectives as a measure of performance indicators within the time framework to achieve identified targets. The higher education system needs demand-oriented, well-established objectives established by assessment units (Lontok, R. M., Al-Ghassani, A. M., & Al-Saidi, O. M. 2013).

The whole exercise of assessments is consistent with the mission and vision of higher education institution aligned with the strategic planning process.

4. LEARNING OBJECTIVE AND PROGRAM OUTCOME

Designing learning objectives and program outcomes is a very challenging task. Learning needs to be contextual, meaningful, well-defined, involving collaborative effort and to be relevant in the real world learning objectives must be built to help learners acquire expertise and knowledge through authentic learning activities (Marzano, R. J. 2010). Learning needs, industry demand, market demand, and clients' demand are some of the factors that influence the design of processes in a learning environment. Market opportunities, Tutor modelling and scaffolding, Library support, online support etc. are some of the issues that are considered while designing a proper learning environment. Course profiles are designed with intended learning outcomes and all the assessment components are designed to test the learning outcomes (Marton, F., &Säljö, R., 1976). Each program has certain learning objectives, the students supposed to achieve the intended learning outcomes only then the student is expected to have satisfied the program outcomes. The learning objectives must be tested on domain-referenced tests, competency tests, basic skills tests, mastery tests, performance tests, authentic test, objective-referenced tests, standards-based tests and credentialing exams, and many more.

5. COURSE PROFILING AND COURSE REVIEW

The course profile is the main document that describes each and every activity of the course to the students. It is like the main principle document that guides and suggests what is going to happen in the course. It covers all the details about a teacher, course description, learning objective, and program objective. A sample course profile is listed in Appendix-1 The higher education system is divided into the semester system, with two to three semesters in a year. Each semester, students are offered courses based on their level of learning. At the end of each semester, a course review is done in which all the achieved grades of students are analyzed, and the progression rate is determined. All the learning objectives must be reflected in the assessment component; that matrix is mapped against the questions and the learning objectives. Course review input is given to program review and then each program is assessed according to its delivery and program objectives as illustrated in Figure 3.

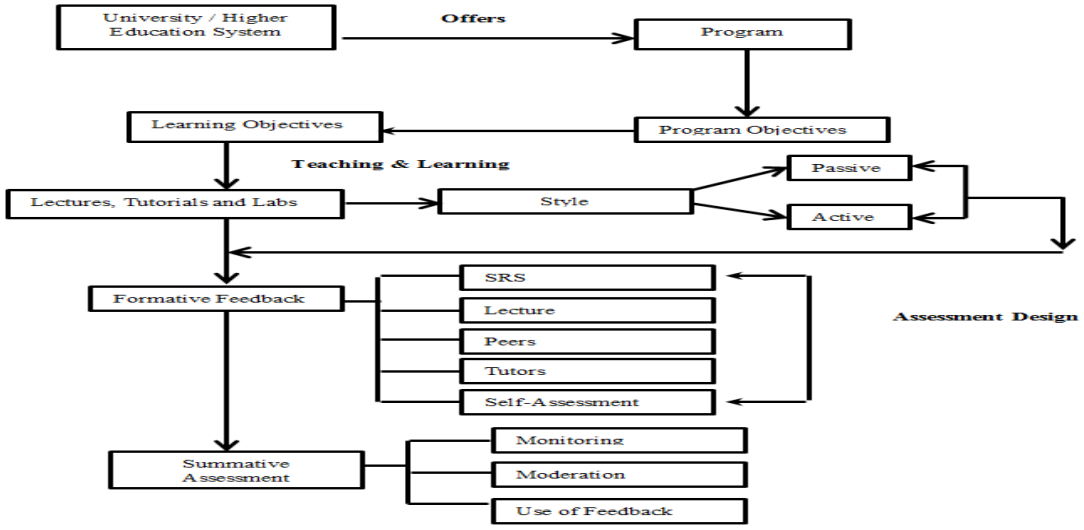

Figure 3: Higher Education Assessment feedback process.

6. MODERATION PROCESS FOR QUALITY IMPROVEMENT

All the assessment components are moderated against the learning objectives, learning outcomes, and program outcomes through the assessment component. Each component can be divided into the written exam, practical exam, lab exam, test, quiz, presentations, demonstrations, projects etc. These are some of the assessment components, which should be mapped through learning outcomes and program outcomes.

The moderation process always helps in improving the quality of the assessment component, and it helps in getting the correct assessment. The moderator of the course is involved with the course coordinator throughout the course delivery process, and all the assessment components must be moderated.

Criteria:

Satisfied Fair Unsatisfied

a) The majority of key elements of the course are covered

b) No extra emphasis on any topic is found

c) Problem-solving questions constitute the majority of exam questions

d) Questions have a varying range of difficulty

e) The language of the questions is clear and specific

f) The type of required response is precisely defined

g) The time allowed for the exam is suitable for the questions

h) Question paper is free from content and spelling mistakes

Course profiles contain objectives, which are nothing but a range of knowledge, graduate attributes etc., which are difficult to measure on a certain scale. Measurement of teaching quality and learning experience is a difficult task as it is multi-criteria based.

6.1 Criteria-Based Assessments

Assessments can be classified based on criteria and can be Direct or Indirect assessments in the learning environment (Tian, X. (2007).

Broadly, Assessments are categorized as

i. Formative
ii. Summative
iii. Continuous
iv. Norm-Referenced
v. Criterion-Referenced
vi. Criterion-Referenced
vii. Rubric

All the courses and programs of the university have one or the other type of assessments, which will help them to determine the level of learning and understanding. Assessment criteria are determined based on course work, Class tests, examinations, presentations, projects, and dissertations and thesis. Figure 3 explains the mechanism of assessments and feedback issues in the university higher education system.

7. QUALITY ASSURANCE AND ASSESSMENT PRACTICES

Enormous transformation is happening in new age knowledge and the higher education system has to cope with this turbulence (Panadero, E., & Alonso-Tapia, J. (2013).

The epistemic dimension in this development process of academic knowledge production to societal knowledge production brings new practices, but also uncertainty for today's knowledge-based society, which brings enormous pressure in the process of assessments and assurance. (Creemers, B., & Kyriakides, L. 2007).

Some of the issues need to be addressed according to delivery and learning objectives which are as follow

- Contents of the delivery and depth and breadth of the contents delivered.
- Discussions and arguments in the domain delivery, evidence to support arguments, critical thinking, conclusions drawn, and focus given to the issue.
- The attention of the reader or audience, Questions raised and comments given on the assessment, effectiveness of the assessment is measured.
- Is there an effective overall structure, coherency, identifiable beginning (introduction), middle (summary), and end (conclusion)? 'Signposting' of structure and creativity, use of imagination in content or presentation, and or originality should also be evident.

Based on the study, below are the research questions.

8. SIGNIFICANCE AND RESEARCH QUESTIONS

This study adds to the Program Objective and Learning Objective literature in three significant ways:

(a) Aspects of learning objectives in higher education to improve the performance of a student.

(b) Investigating the aspect of learning objectives of various courses that most impact program objective achievement. Three specific research questions have arisen from the analysis of archival

data. This study answers the following questions:

(1) Do course objectives (COs) based on Bloom's taxonomy improve the performance of the students?

(2) Does Assessment help to achieve the course objectives (COs).

(3) Reflection of CO's in the measurement of PO1, PO2,.. PO12.

Based on the past research, we hypothesize that course takers will improve their performance on the basis of course objectives to achievement of program outcome to improve their higher studies.

9. METHOD OF STUDY

This article explains the mapping of course objectives with program objectives with the help of case study. The above discussed the teaching practice and assessment practice, currently applied in higher education system.

This study consist the four courses from the higher education system over four consecutive years. Considers these four courses X1, X2, X3, X4 from I year, II year, III year, and Final year, respectively.

Table 1 shows the statistics of Test-1, Test-2, Test-3 and Internal Assessment marks for X1 course.

The number of students in this course are 555. Initially course instructor has developed the course outcome on the basis of the revised bloom taxonomy. The cognitive processes of Bloom's revised taxonomy are remembering,

Understanding, Applying, Analyzing, Evaluating, and Creating. Bloom taxonomy is defined in levels. Level-1 is the very basic level which consists the level Remembering, Level-2 represent the Understanding, level-3 represent Applying, level 4 is Analyzing, level-5 is evaluating whereas level-6 is creating.

The column defined the sum of the marks of the students, the mean of the marks and the variance of the marks. The test is designed on the basis of defined course objectives. It is possible that all course objectives may not be covered in one test. As it is seen that Test-1 course objectives CO1 and CO2, is mapped to Bloom's level-1 and level-2. To improve the performance of the student it is a challenge for the student may perform in a consistent manner.

Table 1: Descriptive Statistics of Course X1.

Groups	Test-1				Tets-2			Test-3			Internal Assessment		
	Count	Sum	Average	Variance	Sum	Average	Variance	Sum	Average	Variance	Sum	Average	Variance
CO1	555	25640.909	46.199836	681.82114				21870	39.405405	1098.3823	42050	75.902527	519.34672
CO2	555	16427.778	29.5996	630.33812	13520	24.36036	1477.3428	23100	41.621622	1436.3322	45580	82.274368	491.38209
CO3	555				24688.889	44.484484	705.97513	26300	47.387387	1972.0428	41980	75.776173	562.95885
CO4	555				44991.667	81.066066	1239.9615	29573.333	53.285285	781.70647			
CO5	555							36012.5	64.887387	769.75828			

As shown in Table-1, Test-3 is designed to cover all the CO's but it reduces the average of student marks in Test-3 for CO1. It is being said that as the course evolve during the semester, the student knowledge level increases rather than decreased. Another issue is, a student does not perform well during the semester predefined exams but the average is quite high for internal assessment.

Likewise table 2, table3 and table4 shows the descriptive statistics of Course X2, X3, and X4. Count in the tables refers number of student in particular course. As different course registration consist different number of student, thus count of number of student is varying.

Table 2: Descriptive Statistic for the course X2.

	T1				*T2*			*T3*			*TA*		
Groups	Count	Sum	Average	Variance	Sum	Average	Variance	Sum	Average	Variance	Sum	Average	Variance
CO1	251	2740	10.91633	384.357							16725	66.63347	311.1211
CO2	251	9575	38.14741	534.7875	3625	14.5	643.5743				16725	66.63347	311.1211

CO3	251	216.6667	0.863214	35.91855	8328.125	33.17978	260.2845	11791.18	46.9768	348.54	17050	67.92829	255.6908
CO4	251	3591.667	14.30943	654.1434				11250	44.82072	613.8961	16725	66.63347	311.1211

Table 3: Descriptive Statistics of the course X3.

	T-1				T-2			T-3			TA		
Groups	Count	Sum	Average	Variance	Sum	Average	Variance	Sum	Average	Variance	Sum	Average	Variance
CO1	445	26222.25	58.9264	1155.473	14150	32.01357	1484.145	22160	50.02257	904.6375	35066.67	78.8015	697.9472
CO2	443	22842.59	51.56341	960.8793	26273.44	59.44217	603.7868	31810	71.80587	927.9532	34941.67	78.5206	791.5064
CO3								15037.5	33.9447	964.424	35708.33	80.24345	584.619
CO4					9200	20.81448	1161.58	19610	44.26637	663.318	34833.33	78.27715	654.7453
CO5								33409.09	75.41556	396.0701	32875	73.8764	650.3238

Table 4: Descriptive Statistics of the course X4.

	T1				T2			T3		
Groups	Count	Sum	Average	Variance	Sum	Average	Variance	Sum	Average	Variance
CO1	144	3837.5	26.64931	507.5317						
CO2	144	3808.333	26.44676	673.3973	7537.5	52.34375	1158.148	9267.857	64.36012	347.95
CO3	144	7360	51.11111	881.6239				6133.333	42.59259	925.7101
CO4	144	3425	23.78472	288.1981	3425	23.78472	288.1981	8925	61.97917	823.5905
CO5	144	7000	48.61111	687.6457	7000	48.61111	687.6457	5813.636	40.37247	380.7133

Based on the statistics of these courses for every year of higher education system we formulate the first hypothesis that course objectives helps to improve the performance of students.

9.1 Results of Hypothesis-1

- Hypothesis H0: Course Objectives help to improve the performance of the students. (Null hypothesis)
- H1: Course Objectives does not help to improve the performance of the students.

To test this Hypothesis a t-Test is conducted on various course objectives during the semester using evaluation technique. Table 5,6,7,8 shows the t-test for course X1, X2, X3, X4

Table 5: T-test for Course X1.

	CO1	*CO1*	*CO2*	*CO2*	*CO2*	*CO3*	*CO3*
Mean	46.1998	75.81982	29.5996	24.36036	41.67419	44.48448	47.38739
Variance	681.821	522.2057	630.3381	1477.343	1437.393	705.9751	1972.043
Observations	555	555	555	555	554	555	555
Pooled Variance	602.013		1054.255	1457.386		1339.009	
Hypothesized Mean Difference	0		0	0		0	
df	1108		1107	1107		1108	
t Stat	-20.11		2.664223	-7.55164		-1.32152	
P(T<=t) one-tail	3.2E-77		0.003914	4.48E-14		0.093301	
t Critical one-tail	1.64623		1.646231	1.646231		1.64623	
P(T<=t) two-tail	6.3E-77		0.007829	8.96E-14		0.186602	
t Critical two-tail	1.96211		1.962109	1.962109		1.962107	

Result of sample assuming equal variance suggest that course takers did improve their performance for CO1 as t value = -20.11, p=.0000; but differ from CO2 and CO3 as t value =2.66, p=.003for CO1, t= -1.3, p=.09 for CO3 respectively. This suggests that the course objectives are likely to improve the

performance of course takers. Moreover p =.09, comparison to our selected α level =< 0.05 consider very high for CO3.

Table 6: T-test for Course X2.

	CO1	CO1	CO1	CO2	CO2	CO2	CO4	CO4
Mean	56.73409	31.93182	50.13636	51.18388	59.55611	71.72727	20.85227	44.31818
Variance	348.7707	1478.036	905.1066	860.221	602.5496	931.4061	1165.844	664.5682
Observations	440	440	440	440	440	440	440	440
Pooled Variance	913.4035	1191.571		731.3853	766.9778		915.206	
Hypothesized Mean Difference	0	0		0	0		0	
df	878	878		878	878		878	
t Stat	12.17227	-7.82224		-4.59176	-6.51857		-11.5051	
P(T<=t) one-tail	6.55E-32	7.43E-15		2.52E-06	5.98E-11		6.24E-29	
t Critical one-tail	1.646591	1.646591		1.646591	1.646591		1.646591	
P(T<=t) two-tail	1.31E-31	1.49E-14		5.04E-06	1.2E-10		1.25E-28	
t Critical two-tail	1.96267	1.96267		1.96267	1.96267		1.96267	

	CO2	CO2	CO3	CO3	CO3	CO4	CO4
Mean	38.14741	14.5	0.863214	33.17978	46.9768	14.30943	44.82072
Variance	534.7875	643.5743	35.91855	260.2845	348.54	654.1434	613.8961
Observations	251	250	251	251	251	251	251
Pooled Variance	589.0719		148.1015	304.4122		634.0198	
Hypothesized Mean Difference	0		0	0		0	
df	499		500	500		500	
t Stat	10.90404		-29.7487	-8.85882		-13.5747	
P(T<=t) one-tail	2.81E-25		5.4E-113	7.08E-18		2.94E-36	
t Critical one-tail	1.647913		1.647907	1.647907		1.647907	
P(T<=t) two-tail	5.61E-25		1.1E-112	1.42E-17		5.89E-36	
t Critical two-tail	1.964729		1.96472	1.96472		1.96472	

Results of Course X2 shows that the course takers differ from the performance as CO2 t value = 10.9,p= .0000 , CO3 = -29.7, p= .000, CO4=-13.5, p=.0000 respectively.

Table 7: T-test for Course X3.

Table 8: T-test for Course X4.

	CO2	CO2	CO3	CO3	CO4	CO4	CO5	CO5
Mean	26.6317	52.34375	51.11111	42.59259	23.78472	61.97917	48.61111	40.37247
Variance	673.1795	1158.148	881.6239	925.7101	288.1981	823.5905	687.6457	380.7133
Observations	143	144	144	144	144	144	144	144
Hypothesized Mean Difference	0		0		0		0	
df	267		286		232		264	
t Stat	-7.20074		2.404507		-13.7458		3.02467	

P(T<=t) one-tail	3.05E-12		0.008415		3.76E-32		0.001367	
t Critical one-tail	1.650581		1.650199		1.651448		1.650646	
P(T<=t) two-tail	6.1E-12		0.01683		7.53E-32		0.002734	
t Critical two-tail	1.968889		1.968293		1.970242		1.96899	

Likewise results of table 7, 8 shows that the course takers have significant decrement of their knowledge level for different course objective at majority of the times. Students achieved t-values t value = 12.1, p=.0000 for CO1, t= -4.5,p=.0000 for CO2, t=-11.5, p=.000 for CO4 respectively at course X3. Therefore, the hypothesis that the course takers would significantly improve the performance during the semester evaluation on the defined course objective is not supported.

9.2. Results of Hypothesis-2

- Hypothesis H0: Assessment correlates the CO's. (Null hypothesis)
- H1: Assessment does not correlate the CO's.

One way analysis of variance (ANOVA) tests were run to test for cohort differences in average CO attainment for various theory and Lab courses. Prior to running analysis it has been predicted that there is a significant relationship between the assessment and course objectives, defined at the beginning of the semester.

Course objectives (CO's) of various courses are numbered as C1.1, C1.2.. for the course X1, C2.1, C2.2.. for the course X2, C3.1, C3.2.. for the course X3, C4.1, C4.2.. for the course X4 in Table 9,10. Average CO attainment is calculated as per higher education governing body. Calculation is as follows: Basis on the percentage of students scored greater than target percentage, an attainment level is marked accordingly. Universities have considered the attainment level is considered as 3 if the percentage of student >=80% than the target level corresponding to CO. Likewise 2 is defined as between 80% and 70% and 1 is defined between 70 and 60. A "0" will be awarded below 60%. Table 8 shows the average Co attainment of Theory Courses X1, X2, X3, X4. Table 11 and Table 12 shows the ANNOVA Results.

Table 9: Average CO Attainment for Theory Courses.

Average CO attainment for Various Theory Courses															
Course-1, I year				Course-2, II year				Course-3, III year				Course-4, IV year			
COs	Test 1	Test 2	End Term	COs	Test 1	Test 2	End Term	COs	Test 1	Test 2	End Term	COs	Test 1	Test 2	End Term
C1.1	0		0	C2.1	0		0	C3.1	1	0	0	C4-3.1	0		
C1.2	0	0	0	C2.2	1	0	0	C3.2	0	2	2	C4-3.2	0	1	3
C1.3		0	0	C2.3	0	0	0	C3.3			0	C4-3.3	0	1	0
C1.4		3		C2.4	0		0	C3.4		0	0	C4-3.4		0	2
C1.5			0					C3.5			3	C4-3.5		1	0
C1.6			2												

Table 10: Average CO Attainment for Laboratory Courses.

Laboratory Courses																				
Course- I, I year						Course- 2, II year										Course-3, III year				
COs	Eval 1	Lab Test- 1	Eval 2	LabTest- 2	Project	COs	Lab Test-1	Lab Test-T2	Quiz 1	Quiz 2	Quiz 3	Quiz 4	Quiz 5	Quiz 6	Project	COs	Eval-1	LabTest-1	Project	Lab Test -2
C1.1	1					C2.1			0							C3.1		2		
C1.2		2				C2.2				1						C3.2	1			

C1.3			1.0		3	C2.3	2				2	2				C3.3				3
C1.4			1		0	C2.4							2	2		C3.4			3	
C1.5				3		C2.5		3												
C1.6				3		C2.6									3					

Table 11: Annova Test for Theory Course.

Year	*Groups*	*Count*	*Sum*	*Average*	*Variance*
I Year	Test 1	2	0	0	0
	Test 2	3	3	1	3
	End Term	5	2	0.4	0.8
II Year	Test 1	4	1	0.25	0.25
	Test 2	2	0	0	0
	End Term	4	0	0	0
III Year	Test 1	2	1	0.5	0.5
	Test 2	3	2	0.666667	1.333333
	End Term	5	5	1	2
IV Year	Test 1	3	0	0	0
	Test 2	4	3	0.75	0.25
	End Term	4	5	1.25	2.25

ANOVA						
Source of Variation	*SS*	*df*	MS	F	P-value	F crit
Between Groups	7.578455	11	0.68895	0.698179	0.72975	2.137907584
Within Groups	28.61667	29	0.986782			
Total	36.19512	40				

Table 11 count shows the number of CO's mapping to particular test for each year whereas as average column shows the mean of attainment of various CO's Since the table clearly indicates that the p-value is 0.7 which is greater the alpha value(=0.5). It indicates that there is no significant relationship between CO's and the test conducted to assess the student. Therefore, the hypothesis that the assessment correlates the CO's at the end of the course was not supported.

Likewise that average attainment level for the same lab courses is also measured. Table 12 shows the Annova test for Laboratory Course X1, X2, X3. X4 is not being considered due to absence of lab work.

Table 12: Annova Test for Laboratory Course.

Year	*Groups*	*Count*	*Sum*	*Average*	*Variance*
I year	Eval1	1	1	1	Err
	Lab Test- 1	1	2	2	Err
	Eval2	2	2	1	0
	LabTest- 2	2	6	3	0
	Project	2	3	1.5	4.5
II year	Lab Test-1	1	2	2	Err
	Lab Test-T2	1	3	3	Err
	Quiz1	1	0	0	Err

	Quiz2	1	1	1	Err
	Quiz3	1	2	2	Err
	Quiz4	1	2	2	Err!
	Quiz5	1	2	2	Err
	Quiz6	1	2	2	Err
	Project	1	3	3	Err
III Year	Eval-1	1	1	1	Err!
	LabTest-1	1	2	2	# Err
	Project	1	3	3	Err
	Lab Test -2	1	3	3	Err

Results shows that the p-value = 0.7880403 which is greater than alpha level (.05). Therefore hypothesis doesn't support that there is correlation between assessment pattern and course objectives.

9.3. Results of Hypothesis-3

- Hypothesis H0: Does CO's reflect the measurement from PO1, PO2 and so on. (Null hypothesis)
- H1: CO's does not reflect the measurement from PO1, PO2.

Reflection of CO's with PO's a predefined formula were utilized to determine the aspects of course objectives to match the programme objectives. Table 13 and Table 14 shows the result.

Table 13: Reflection of CO's with PO's of various Theory Courses.

PO-PSO-Attainment (Theory Courses)														
Courses	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
I year	2.1	2	2.1	2.1	2.1	2.1		2.1	2	2	2	2.1	2	2
II year	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.3	1.4	1.4		1.4	1.26	1.25
III year	2.1	2.4	2	2.2	2.44	2.6						2.2	2.2	2.5
IV year	1	1	0.96	0.8	1	0.8							0.92	0.83

Result shows that the attainment level of some of the course objective in each assessment criteria is low then mapping of the program objective is low. Table 13 shows that the PO7 is at all not achieved the I , III and IV year course. Blank space shows the attainment level is 0 to the particular CO's. Low attainment level is also achieved somewhere. Reflection of CO- PO mapping reflect the attainment below 60% or above 60%.

Table 14: Reflection of CO's with PO's of various Laboratory Courses.

PO-PSO-Attainment (Lab Courses)														
Courses	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
I year	2	2.1	2.16	2	2.055	2.24		2.055	1.96	2.022	1.7	2.054545	1.96	2.05
II year	1.0	1.5	1.5	2.0	0.0	2.1	2.1	2.3	1.9	1.9	1.4	2.3	1.89	1.98
III year	2.3	2.2	2	2.3	2.4	2.3		2.3	2.4	2.3	2.5	2.3	2.1	2.3

Table 14 shows the reflection of PO's corresponding to CO's for the various laboratory courses. Result shows that the lab courses have achieved maximum PO's. Therefore it is considered that there is a significant relationship between the course objectives and program objectives.

10. CONCLUSION

This paper discussed the quality improvement challenges in Higher education system. Result show examinations alone can't prove to be sufficient in assessment to achieve course objective. Today higher education is becoming more and more challenging in

terms of assessments. Learning Objectives, Program Outcomes, Course Profiling, Course Review, and Annual Program Monitoring Reporting System in higher education system are all major parameter in the higher education quality based on assessments and assessment quality.

Learning outcomes are not only determined based on an exam, but it also to be tested for communication, teamwork, and power of expression, quality of learning and authenticity of the learning material supported by technology. Active learning, proactive studentship, resource availability, and learning resources availability are some of the issues that make current assessment practices more challenging. Some of the processes that are difficult to assess are peer support, process regulations, meta-cognitivism, communication skills, logical thinking, effective skills, and disciplinary knowledge. Researched informed deep learning is a very important concept which is emerging in higher education and assessing such learning is very challenging. Learners should take initiatives, reflective and evaluating learning process and tasks, which can be assessed by authentic assessment using the latest technology tools and IT solutions.

Technology-enabled learning promotes Bulletin board discussions, formative interpersonal skills, collaboration, and higher-order thinking has to be prioritized in assessment design. Blogs, formative reflection, portfolios, etc., are some of the issues that need proper attention in assessment. Self-assessments, peer review assessments, formative & summative collaboration, metacognition, self-evaluation, and self-monitoring are some of the emerging issues that need attention while improving the assessment quality.

University-industry liaison committees and board of studies are constantly active in order to update the syllabus for industry needs, curriculum design issues, project management issues, technical issues etc. In this situation assessment process should also get update accordingly to improve the quality of higher education system.

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