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"Implications of a Smart Software to Measure the Graduate Attributes, Program Learning Outcomes and Course Learning Outcomes"

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Abstract
Evolution of higher education institutions (HEIs) evidently depends upon its infrastructure, resources, facility and quality education, aimed to fulfil the institutional vision, mission, objectives and values. Various policies, procedures, bylaws, strategic, operational plans are meticulously drawn and stringently followed to mark accomplishments. Accomplishments are solely measured via delivery and attainment of quality envisioned traits termed as graduate attributes, program learning outcomes and course learning outcomes. These core traits are designed to meet the institutional expectations over long period. Although there have been various studies and indirect methods to track the efficacy and delivery of these core traits, what is most significantly lacking is a scientific approach to authentically measure these traits. Hence, critical problem to measure these traits withstands. Followed by years of consultation and research, understanding the need to develop an approach, we have developed a unique innovative software tool that follows an innovative and analytical methodology to scientifically quantity the distribution and achievement of these core traits. The software uses highly complex mathematical calculations applied on grades of formal assessments served as input and produces statistics to be analysed by academic experts to systematically determine the strengths and weaknesses of students, courses and academic programs.

INTRODUCTION AND BACKGROUND STUDY

For an organization to sustain and uphold a successful model; it must form and follow the core principles of its business initiatives, techniques and relevant processes designed through its ambitious strategic and operation plans. As mentioned by Güven et al. (2011), strategic organization plans are specific, direct the operations of an organization and differentiate its functions from others. Hence, the initial framework for an organization starts through careful and meticulous establishment of its goals in the form of vision, mission, objectives and core values. These attributes provide a pathway and lead the organization to build upon its strategic and operational plan. As stated by Güven et al. (2011), strategic management is an initiative that helps an organization to implement viable actions to realize its intended goals and objectives. Simultaneously, strategic plans are instruments that involve making long term commitments to improve efficiency by building on these plans. These strategic plans, however, are built upon possible opportunities, include the associated risks, and formulate the core organizational components, such as vision, mission, strategy and actions. Hence, strategic plans guide building on organizational core strategies, such as mission, vision, objectives and core values. Güven et. al. (2011) also clearly specified that the mission statement leads and guides the strategic plan of an institution in the right direction, or else the operations could be diverted, leading to distributed irrelevant alternatives. Similarly, vision statements are another building block focusing the long-term vision of an institution. They are formed considering the current facts, situation, reveries, prospects and intimidations leading to an appropriate future (Güven et. al. (2011)). In general, mission statements aim to achieve the vision; hence, both together

form an effective strategic and operational plan for any institution to strive and be successful in the competitive world.

Similarly, carefully drafted and defined HEI initiatives play a vital role to the growth and development of any (Aithal (2016)). As stated by (Jennifer et al. (2016)), Graduate attributes (GAs) are knowledge, skills, attitudes and values, which should be progressively instilled in graduates throughout their academic tenure. Elke et al. (2014) stated that GAs should be realistic and should be practically delivered seamlessly throughout the curriculum. Barbara et al. (2012) suggested that the institutional policies and guidelines should support academic experts to efficiently instil GAs into the curriculum. Curriculum of academic programs generally focus to achieve defined GAs which is reflected in developing course descriptions, program learning outcomes (PLOs) and course learning outcomes (CLOs). It is important to align the teaching and learning strategies to confirm the delivery of GAs in the curriculum (Green et al. (2009); Sumsion et al. (2004)). Thus, the developed GAs in general should encompass all of the critical generic skills and reflect the national, as well global, requirements of the industry and employers. Whereas GAs are defined to be accomplished at the institutional level, PLOs are specifically designed through academic programs, in consultation with academic experts, to realize the GAs, and this process forms an academic curriculum. Various other attributes are associated with the curriculum, such as those specified by Harden et al. (2009), to maintain consistent alignment and amalgamation between the sequences of various courses within a program it is vital that the learning outcomes are formed as a prevailing base for the formation of curricula. Per studies, various skills, such as research and analytical skills, critical and creative thinking, presentation and communications skills and other information competencies, should be injected into the courses constituting an academic program (llene (2019)). Hence, PLOs, which reflect the delivery and attainment of specific academic programs, must be carefully designed, and their outcomes should be consistently mapped with GAs.

Lowden et al. (2011) states that though HEIs are trying to address the employers and industry requirements, there are still significant factors that could address and promote graduates employability. Arcelo et al. (1987) specifies that it is often noticed that one of the major cause of unemployment is due to inconsistency between the job market requirements and the capabilities of the graduates. Job specific requirements differ from an employer to another hence the range of competencies to work in a global environment would differ under different situations and culture. It means that though most of the graduates would have basic similar analytical and reflective qualities, job specific requirements have to be enhanced in the academic tenure. Now, the questions that arise: are academic programs addressing the evolving requirements of the industry and employers? Are the institutions following any scientific methodology to measure the GAs, PLOs and CLOs? The obligation of HEIs is to withstand and precisely identify the strengths and weaknesses of every graduate, course and academic program. But this is not adequately addressed in the current scenario. Where authentic education is considered the core foundation to the development of human capital (Sayed et al. (2022)), we believe that the delivery and attainment of GAS, PLOs and CLOs if scientifically measured, standing issue to the delivery of quality education can be efficiently addressed.

Followed by years of consultation with higher education academic experts, we developed unique software to measure the delivery and attainment of GAs, PLOs, and CLOs. This software tool has been tested and simultaneously been run on pilot basis, tested with selected courses and faculty members, at one of a highly reputed HEI middle east and the results are captivating. These results are produced in the form of numbers, percentage and charts and can be easily analysed by academic experts to identify the strengths and weaknesses of students, courses, and academic programs.

LITERATURE REVIEW AND STATEMENT OF THE PROBLEM

Studies have revealed that the skills of graduating students sometimes do not match the requirements of a job market (NACE 2011). It is mandatory to mention that an academic program must deliver the knowledge and

skills, as anticipated through the HEI's goals and its derived attributes. Frameworks for practical and research skills, in addition to the theoretical components, should be equally embedded and widely concentrated through learning strategies and alignments, and achievements of GAs should be validated through such hybrid assessments (Pretorius et al. (2013)). Barrie (2012) specified that HEIs have been attempting to build a clear and concise strategy to equip graduates with the required knowledge and skills, but despite all of the efforts, the graduates still lack the mandatory knowledge and skills to meet the community requirements. Simultaneously, Jeannie et al. (2014) mentioned that the HEIs have stimulated their focus to produce graduates who can very well adapt to the requirements of employability by the community and industries; thus, in order to cope, most of the institutions have integrated and embedded the requirements into their graduate attributes. Thus, although HEIs are aware that there is a tremendous need for change and improvement in the way in which education is delivered and tracked as anticipated by industry and community, despite trying its best, there remains a lack of formal and innovative approaches to handle the concern. Generally, building GAs into a university-level education focuses on career building processes and aspects related to lifelong learning skills and adaptability to industry standards (Ruth (2009)).

Our research focuses on the area of a higher educational setting, hence it is important to mention that any HEI will have developed its GAs and set them in line with the institutional initiatives, such as the vision, mission, objectives and core values. Based on an academic survey, Barbara et al. (2012) also emphasized that GAs are too vital for any academic institution, but the practicality of appropriately incorporating them into the curriculum is a great challenge too. Thus, GAs must be realistic to be perfectly integrated in the curriculum; else the whole purpose of the institutional initiative would be a failure. Another issue, as indicated by Bath et al. (2004), is that the adopted curriculum and the taught curriculum should be designed to justly fit the GAs to assure authentic quality assurance and reporting processes. To address all such concerns, and simultaneously to uphold the veracity and litheness to comply with effective access to various multidisciplinary assignments, HEIs are very much observing the delivery and attainment of GAs in their curricula (Felder et al. (2003)). In addition, the instructor's role in designing and delivering the course content, mapped with GAs, is also vital in addressing such concerns (Bath et al. (2004)). These studies indicate that, although HEIs are struggling to overcome the standing issues, there still exists an enormous gap to acknowledge and overcome the underlying concerns of employability, quality of education, apt revamping of academic courses and programs, benchmarking the institutional initiatives with the delivery of academic programs and assessments, and identifying the skills or strengths and weaknesses of students in an academic program. Simultaneously, whether it is to the development and benchmarking of appropriate institutional initiatives, relevant institutional policies and procedures, development and mapping of GAs or learning outcomes, a faculty member plays a vital role to these processes. During the past two decades, Quality Assurance (QA) processes have greatly influenced the establishment and application of GAs in Australian HEIs (Barrie (2006); Kalfa et al. (2015)). Throughout the globe several institutions have also integrated GAs to their curriculum, aligned with its requirement. Unless the delivery of a course or academic program is perfectly traced, analysed and appositely developed or improved, the question is how are they going to evaluate and assess the accomplishments?

Having proved that GAs is very crucial, the problem of tracking the achievement or attainment has been a serious concern throughout the educational system. An authentic measure of actual attainment of these attributes is seriously lacking and not satisfied in most of the educational system. The most commonly applied procedure to measure the delivery of learning outcomes and graduate attributes is using a questionnaire, whereby the students, upon completion of a program, are required to complete a feedback survey to evaluate their learning experiences correlated with its attributes (Bath et al. (2004)). The derived data from the questionnaire are then accumulated and discussed across various platforms to identify the attainment of outcomes and to observe the strengths and weaknesses of a delivered course or program (Uchiyama et. al. (2008)). Such methods are useful but do not encompass any measurable legitimate phenomenon to attest to the requirements since the students always have the liberty to complete the questionnaire using their best available

choices or convenience.
Our research thus focuses on the key element of higher education, which is GAs, since the overall purpose of GAs is to ensure if the HEI is progressing ahead in the right direction to achieve its intended and predefined goals, aligned in line with the employability requirements and related aspects (Ruth (2009)). It focuses on a statistical technique through calculative and formal measures, gained through assessments of students, toward the attainment of GAs in conjunction with various other related factors to attest to and raise the limits of success in this regard. As specified by Billie et al. (2017), rubrics related to assessments should clearly define and relate to the students' learning outcomes and reflect competencies in terms of expected internal or external priorities. We believe that the formation of formal authentic assessments and the performance of students in those assessments are the most critical ways of evaluating the success or failure of an academic program. With the principle of outcome-based education (Bakker et al. (2015)), the assessments in our research are uniquely prepared to ensure the delivery and attainment of these vital learning outcomes. The data on assessments in our system is systematically archived and stored as domain knowledge with respect to the CLOs. Likewise, the weightage of data from the assessments is used to analyse, gather, forecast and recommend effective future developments with respect to the strengths and weaknesses of each student. Our proposed unique patented assessable methodology ensures overcoming the challenges and appropriately addresses the issues by tracking and measuring the outcomes and deliverables of each student and each academic course, using authentic reckonable methods applied to assessments. Our system is designed to progressively track the performance of each student, in each course via each assessment, hence it is absolutely coherent that each piece of assessment data relevant to every student in every course will help to identify and assess the functionality of the proposed system, with respect to the graduates and academic programs.

Analysis of the related work and proposed exemplar

In any academic program, PLOs are critically sought to develop the course descriptions, PLOs also indicate that all of the courses together would provide a general overview of the contents as an academic program. Consecutively, to ensure the delivery of indispensable and continuing disciplinary knowledge and skills, CLOs are defined as direct input statements to measure achievements upon the completion of a course (Anderson et al. (2001)). Mapping processes of contents to their curricula is basically executed by academicians specialized and competent in the field (Lam et al. (2013)) since it is their professional responsibility to its legitimacy at the level of higher educational delivery (Plaza et al. (2007)). In contrast, it has also been found that few academic staff apply the process of integrating the GAs into the teaching pedagogies and curricula (Barbara et al. (2012). To overcome any setbacks, as specified by Jason et al. (2014), it is important that faculty members be provided with continuous development programs, seminars and workshops specifically in the fields of improved teaching and learning. Thus, improved parameters and consistent advancement to faculty development programs in the context of teaching and learning (Jason et al. (2014)) could have impacts and result in a greater scope to practically realize the mission and vision of the institution. Therefore, it is the obligation of the HEI to ensure that the delivery of attributes, such as GAs and PLOs, are inevitably incorporated into all of its courses (Moalosi et al. (2012)) and appositely implemented by academicians.

It is in line that our proposed paradigm also works with a predefined strategy to enforce the integration of GAs into the teaching curriculum with the notion that GAs are conceptualized and developed with the sole purpose of enhancing and realizing the educational values as intended by the institution. The course instructor, who has the autonomy of designing the course syllabus, must plan and design the course syllabus by firmly mapping the GAs and PLOs sequentially into its prolific consideration (Nasser et al. (2022)). Most of the course curriculum is also prepared in such a way that, apart from technical competencies, the students also acquire skills and attributes that make them responsible social human beings (Bowden et al. (2000)). Along with other key tips and indicators related to the instructional delivery of the course, the syllabus structure should also contain a valid and feasible assessment strategy aligned with the GAs and PLOs. The CLOs which is the connecting key to

the PLOs (UORI 2018), should be cautiously created by the course instructor, mapped through various assessments and should be incorporated into the course syllabus. With the aim of measuring the progressive performance of a student, every course in an academic program should be tracked to measure the achievement of CLOs (Ronald (2009)); thus, the course instructor with the autonomy to set the outcomes for a course, through apt teaching and learning strategies, should ensure that the assessment procedures measure the outcome set for the course (Bakker et al. (2015)).

Although the delivery of GAs is planned by the course instructor before the conduct of the course, the practicability of assessing the achievement of GAs takes place after the course is delivered. The instructor usually evaluates the attainment by obtaining feedback from the students using a questionnaire. Studies have revealed that students do perform better and achieve quality results throughout their educational periods if they are engaged with high levels of inspiration (Evans et al. (1992)); thus, students' participation on the attainment of the curriculum is vital, through various assessments. Consecutively, to ensure the quality and further development of an academic program, the measure of assessing PLOs has been a topic of great significance (Philip et al. (2009)). Hence, authentic delivery program learning outcomes play a fundamental role in the realization of GAs. Though various methods and practices to measure the delivery and attainment of CLOs, PLOs and GAs in the form of self-appraisal, feedbacks, peer analysis and opinions and are conducted but a convincing, scientific and measurable method is still lacking in the process (Sayed et al. (2020)). The concern here is that, although these methodologies provide an overview of the GAs, PLOs or CLOs, it does not provide the actual measure of delivery or attainment of these attributes. Second, these methods do not address every student's strengths and weaknesses, or even do not address the strengths and weaknesses of each and every PLOs of GAs. Assessments are the only prescribed methods to formally evaluate the accomplishments, knowledge, skills and competencies and would reveal the achievement of students with respect to the program goals. Though clear rubrics and moderation process on the assessments, both pre-assessment and post-assessment, are vital.

Our research hubs on a recently launched unique software application named "Learning Outcomes Blaze™" that uses grades of formal assessments to measure the delivery and attainment of GAs, PLOs and CLOs. "Learning Outcomes Blaze™" is an innovative solution built to efficiently solve the standing global critical issue to measure the graduate attributes, program learning outcomes and course learning outcomes. It is academic that is the software product is researched, created, and developed by academics for academic fraternity. The software is exceptional and is created to exceptionally measure the quality of higher education that is the delivery and attainment of GAs, PLOs and CLOs. The software is compatible with existing institutional systems, can be customized to aptly fit the institutional requirements, is designed, and built to proficiently suffice the core academic requirements of accreditations and quality assurance processes.

Every student's performance is tracked to identify the outcomes of a course and to measure the success of an academic program. More specifically, with well-established and accurately defined CLOs, PLOs and GAs, through authentic assessments, our system produces incredible statistics to:

- Identify the strengths and weakness of students, courses and academic programs.
- Tremendously support the review and further development of courses and academic programs.
- Sustain the institutional quality assurance (QA) processes with respect to student learning outcomes, assessment methods and standards.

Conceptual and logical framework of the system

Figure 1 entitled "Conceptual and logical framework of the system" demonstrates the framework of our proposed system. Initially master matrices of GAs and PLOs are prepared. These master matrices demonstrate the coverage of GAs and PLOs in an academic program. It shows the mapping of courses to GAs and PLOs in an academic program.

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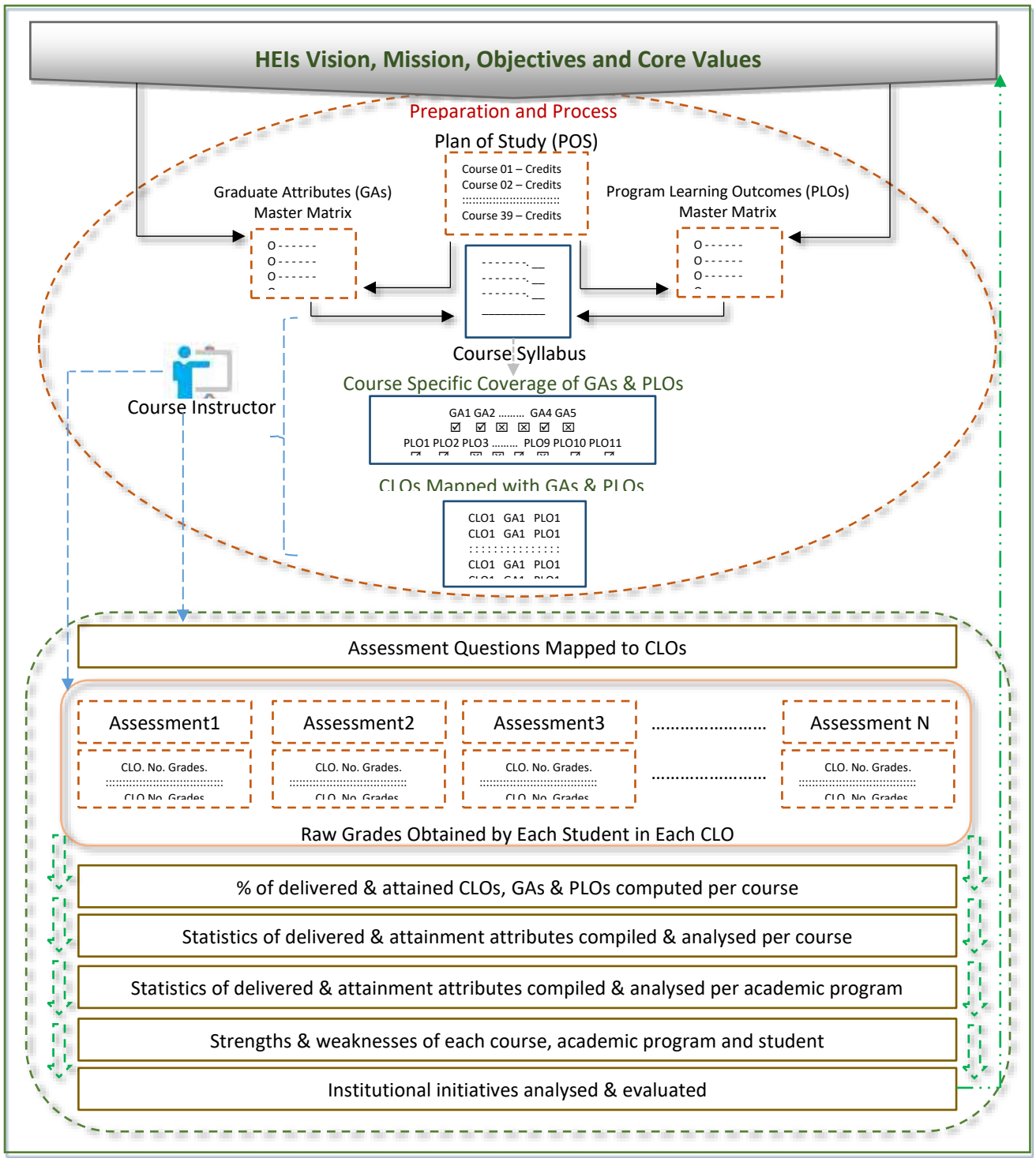

Figure 1: Conceptual and logical framework of the system

Based on this upper level mapping the course instructor aligns each CLOs with the designated GAs and PLOs. It means that the course instructor would map each CLO to a set of GAs and PLOs, indicating its coverage. While preparing an assessment, the instructor ensures to align assessment questions with the corresponding CLOs, ensuring that all of the components of an assessment are fully aligned within the intended outcomes, called "Assessment Questions Mapped to CLOs". Consecutively, after the assessments are conducted, and during the marking or grading stage, the instructor identifies the raw grades obtained by each student in each

CLO denoted as "Raw Grades Obtained by Each Student in Each CLO". Once the input process is over, our system uses automated rigorous mathematical calculations, produces vital statistics to be further analysed by the academic fraternity.

Pilot run, deployment and implementation of the system

This section illustrates the pilot run that was conducted at one of a highly reputed HEI in the middle east. A total of 690 students registered in different courses and different sections were selected to be included in the pilot run of "Learning Outcomes Blaze™". The process involved multiple faculty meetings, demonstration of the software application to the faculty members, data collection formats and procedures for data input to the system including the process of mappings between various key attributes, creation of faculty accounts in the system, grades entry and execution of the system. Though the system was executed at very micro level of learning outcomes called assessment performance criteria's (APCs), in order to make the readers from different academic and scientific disciplines to easily understand the core concepts, we have described the entire proceedings at higher level of learning outcomes that is CLOs.

CLOs were prepared in reference to the course description, as well in light of the master matrices of GAs and PLOs. Each CLO would demonstrate the coverage of GAs and PLOs. The assessments were prepared ensuring the coverage of CLOs. Each assessment is prepared with the objective of delivering and measuring the attainment of applicable CLOs in a course. This process equally applies to all formal assessments in various formats such as quizzes, tests, exams, presentations to fully evaluate the delivery and attainment of course learning outcomes. Therefore, for each assessment, the weightage of each CLO were defined and the grades obtained by each student were precisely recorded. The tables below show a sample template to record the weightage of each CLO and the grades obtained by each student in each assessment.

Preparation of assessment questions:

Course Code: Course Code Course Title: Course Title Section: Section No

CLO Ref.	Assessment1 10%	Assessment2 20%	Assessment3 10%	Assessment4 20%	Assessment5 40%
CLO1		8	2		5
CLO2	4			10	7
CLO3		6	3		8
CLO4			5	6	8
CLO5	6	6		4	12

Marking of assessments:

Course Code: <Course Code> Course Title: <Course Title> Section: <Section No>

Student_Id: <Student_Id> Student_name: <Student_Name>

Assessment1-10%

	CLO1	CLO2/4	CLO3	CLO4	CLO5/6
Student1		2			5
Student2		3			4

Student3		0			6
Student4		1			3
Student5		2			5
Student6		2			2
Student7		4			3

Note: The shaded columns mean that the cells are inactive and those CLOs are not assessed in Assessment1

Assessment2-20%

	CLO1/8	CLO2	CLO3/6	CLO4	CLO5/6
Student1	6		4		5
Student2	8		3		4
Student3	7		6		5
Student4	4		6		5
Student5	4		0		6
Student6	7		4		4
Student7	2		3		4

Note: The shaded columns mean that the cells are inactive and those CLOs are not assessed in Assessment2. This process thus applies to all the assessments in the course.

RESULTS AND DISCUSSION

The statistics derived from the system revealed the amount of delivered and attained CLOs, PLOs and GAs. We were able to analyse that in some courses the CLOs were largely taught and assessed, the student's attainment stood at acceptable level. It was noticed that certain CLOs were attained better in comparison to other CLOs, indicating that the students in a section were more proficient in certain learning outcomes, thereby highlighting the strengths of the students in specific areas. A glance of real statistics for a course from the system is listed below. Course details are concealed for confidentiality purposes.

Statistics from the Software: "Learning Outcomes Blaze™":

With reference to Table 1a entitled "Course learning outcomes - assessment report", it can be noticed that CLO1 has been delivered (assessed) at 4% in quiz1 and the section average of attainment (achievement) is 2.961%. Likewise, CLO2 has been delivered (assessed) at 6% in quiz1 and the section average of attainment (achievement) is 4.345% and so on. Finally, in the last column as seen in Table 1b, it can be noticed that, in total:

CLO1 has been delivered (assessed) at 18% and the section in average has attained at 13.384%.

CLO2 has been delivered (assessed) at 16% and the section in average has attained at 11.961%.

CLO3 has been delivered (assessed) at 20% and the section in average has attained at 17.153%.

CLO4 has been delivered (assessed) at 31% and the section in average has attained at 21.923%.

CLO5 has been delivered (assessed) at 15% and the section in average has attained at 12.500%.

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It can be seen that the delivery of CLOs is 100% and the section attainment average is 76.923%.

Analysis of outcomes by academic expert:

The CLOs have been largely taught and assessed though the student's attainment stands at 76.923% which is satisfactory. In comparison to other CLOs, CLO4 has been significantly taught and assessed largely at 21.923% which means that students in this section are better capable to analyse morphological processes in data from a variety of languages which is CLO4. The system also calculates the strength of each student in each CLO, PLO and GA using the concept of reverse engineering.

Screenshots from the online software application "Learning Outcomes Blaze™".

Software: "Learning Outcomes Blaze™"

Course Learning Outcomes - Assessment Report								
	Delivered		Attained		Delivered		Attained	
No	Quiz1/10				Quiz2/10			
1	40.000%	4.000	29.615%	2.961	40.000%	4.000	33.846%	3.384
2	60.000%	6.000	43.461%	4.345				
3								
4					60.000%	6.000	45.769%	4.576
5								
Total	100.000%	10.000	73.076%	7.306	100.000%	10.000	79.615%	7.960

Table1a: Course learning outcomes - assessment report

No	Course Learning Outcomes (CLO)
-1	Recall definitions of major terms related to morphology.
-2	Identify internal structure of words.
-3	Demonstrate understanding of various word formation processes.
-4	Analyze morphological processes in data from a variety of languages.
-5	Apply linguistic research skills to write an assignment and present it orally.

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 2, 2025
https://www.theaspd.com/ijes.php

Software: "Learning Outcomes Blaze™"

Course Learning Outcomes - Assessment Report

	Delivered	Attained
	% of CLO	
No	18.000	13.384
1	16.000	11.961
2	20.000	17.153
3	31.000	21.923
4	15.000	12.500
5	100.000	76.923

Table 1b: Course learning outcomes - assessment report

Statistics from the Software: "Learning Outcomes Blaze™":

Table 2a entitled "Distribution of program learning outcomes and graduate attributes in the course", shows the distribution of PLOs with respect to the coverage of CLOs in the course. It means that not all CLOs are covered or mapped with all PLOs. Each CLO is certainly mapped to one or more PLOs. In this course, CLO1 is mapped to PLO d, e and h only, CLO3 is mapped to PLO d, e and h only, CLO3 is mapped to PLO d, e, f and h only, CLO4 is mapped to PLO d, e, f and h only, CLO5 is mapped to PLO a, b, d, e and h only. Likewise, each CLO is mapped to one or more GAs. Table 2a is produced followed by the process of mappings between CLOs to PLOs and CLOs to GAs. It can be seen that PLO-a has been distributed at 2.857%, PLO-b at 5.714%, PLO-c is not covered in this course, PLO-d is distributed at 20%, PLO-e at 25.714%, PLO-f at 8.571%, PLO-g is not covered in this course, PLO-h is distributed at 28.571% and PLO-i is distributed at 8.571% in this course.

Software: "Learning Outcomes Blaze™"

Ref.	Program Learning Outcomes (PLOs)	Covered
a	Use listening skills to understand English in a range of contexts with speakers of their own and other languages and with native speakers of English.	✓
b	Demonstrate speaking skills in order to express thoughts, opinions, arguments and a range of language functions to speakers of English and other languages with sufficient clarity and accuracy of language and pronunciation.	✓
c	Apply a range of reading skills and strategies to cope with authentic texts in a range of contexts.	✗
d	Demonstrate writing skills to express thoughts, opinions, arguments and a range of language functions in styles appropriate to the task.	✓
e	Demonstrate the acquired ability to make effective use of grammatical devices and lexical resources of the language for the purposes of efficient communication.	✓
f	Show informed awareness of linguistic systems of English language and demonstrate the acquired ability to identify and analyze the structure and functions of the language.	✓
g	Show informed awareness of different literary genres and demonstrate the acquired ability to critically examine different literary texts in English.	✗
h	Show the ability of independent/autonomous learning by using a range of learning techniques and strategies.	✓
i	Apply study, research and presentation skills in order to increase academic, professional, and employment potential.	✓

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Software: "Learning Outcomes Blaze™"

Ratio of PLOs & GAs Distribution in the Course

	PLO Ref.									
	PLO-a	PLO-b	PLO-c	PLO-d	PLO-e	PLO-f	PLO-g	PLO-h	PLO-i	Total
%	2.857	5.714	X	20.000	25.714	8.571	X	28.571	8.571	100.000

GA Ref.					
Ga-a	Ga-b	Ga-c	Ga-d	Ga-e	Total
28.947	28.947	28.947	5.263	7.894	99.998

Table 2a: Distribution of program learning outcomes and graduate attributes in the course

Analysis of outcomes by academic expert:
Chart 1 illustrates the "Total % of program learning outcomes and graduate attributes delivered and attained in the course". It can be seen that the total % of PLOs delivered in the course is 73.583% and the total % of PLOs attained is the course is 56.453%. Total % of GAs delivered in the course is 88.466% and the total % of GAs attained is the course is 68.135%. Chart 2 shows the delivery of each PLO and each GA in the course. Chart 3 shows the attainment of each PLO and each GA in the course.

Software: "Learning Outcomes Blaze™"

Combined % of PLOs & GAs Delivered & Attained in Section 1 during Spring 2022-2023

	PLOs	GAs
Delivered	73.583	88.466
Attained	56.453	68.135

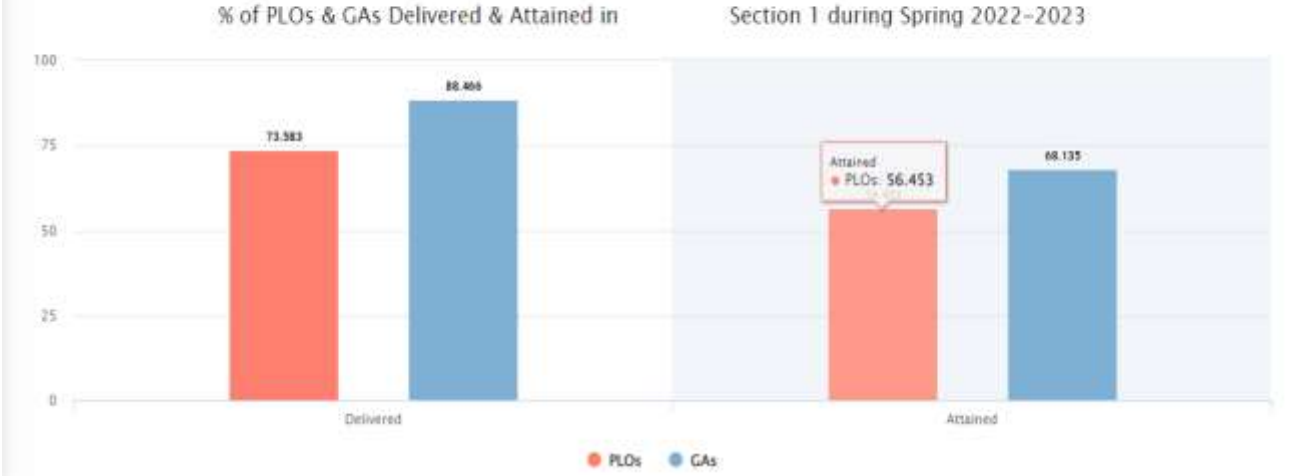

Chart 1: Total % of program learning outcomes and graduate attributes delivered and attained in the course

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Vol. 11 No. 2, 2025
https://www.theaspd.com/ijes.php

Software: "Learning Outcomes Blaze™"

Chart 2: % of program learning outcomes and graduate attributes delivered in the course

Chart 3: % of program learning outcomes and graduate attributes attained in the course

CONCLUSION

The software tool "Learning Outcomes Blaze™" is exciting, since its outcomes potentially leads to detect viable flaws and conceivably identify key areas of improvements in the higher education framework. The tool will seamlessly highlight the strengths and weaknesses of students, courses or academic programs alongside the statistics required for institutional Quality Assurance (QA) processes in all aspects and would help to raise the standards and quality of education in HEI's, much needed to develop the human capital. We claim that once this promising system is implemented, HEIs will be able to produce valid and accurate statistics related to the achievement of GAs, PLOs and CLOs. The software tool Learning Outcomes Blaze™ forms a unique methodology to evaluate the success of a higher education framework, will tremendously support the institutional quality assurance (QA) processes in all aspects and is ready to be deployed and implemented in any HEI followed by minor institutional customizations. HEIs will be able to relook into and revise its pools of CLOs, PLOs, GAs, strategic plans, policies, procedures and strategic initiatives. We sincerely invite all program and institutional accrediting agencies and reputed HEIs to explore our innovative software tool "Learning Outcomes Blaze™" to efficiently reinforce the quality assurance standards in the key area of teaching and learning on which the entire concept of HEI withstands that is to scientifically, efficiently and intelligibly measure the graduate attributes, program learning outcomes and course learning outcomes.

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