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Automating assessment and evaluation for a bachelor's degree program

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ABSTRACT

Outcome-based education (OBE) makes learning happen and measures automating assessment and evaluation system. The objective of the study is to assess student's learning in International Finance course and report OBE and propose strategies for continual quality improvement (CQI). In this study, a widely accepted self-developed spreadsheet used to measure course learning outcomes (CLO) and program learning outcomes (PLO) of international finance in a bachelor's degree program of fall 2021. The method of sampling technique is purposive and a sample of 27 students have been considered for the analysis. Using direct method on specific parameters (quiz, assignment, presentation, and exams), an overall CLO attainment has been measured and compared with a targeted key performance indicators (KPI) (70% is set). Findings reveal that the first three out of five CLO have met the standard KPI. However, a CQI has been proposed for further improvement of CLO. Also, future works proposed to instrument CQI processes, engage industry experts and external OBE experts from foreign universities. Program self-assessment is mandatory for quality assurance at university and also preparation for accreditation of the program needs self-assessment. Therefore, CLO is mandatory for assessment and evaluation urgently.

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1. INTRODUCTION

In 1957, Sputnik-I was launched into the earth's orbit by the Soviet Union, and tension was raised in the United State considering that American society had fallen behind in the space race. The education system was blamed for this and a huge amount of money was invested to modernize the education and training system. That ignited the development and implementation of outcome-based education (OBE) in the education system [1]. OBE is established on a principle that clearly focuses and organizes almost everything in an educational system which is essential for students to be able to do at the end of their educational experiences. This tells us that students are expected to learn and be able to do their learning experiences [2].

Society expects that higher education institution to act on social needs so that various stakeholders are benefited from it [3]. At present, there is widespread interest in the outcomes of educational experiences and how those outcomes meet a variety of societal needs and ensure the sustainable competencies of professionals [4]. So, the purpose of higher education is to create knowledge in society. Keeping this purpose in mind the apex bodies of higher education has introduced policy like OBE in education institute as a mechanism to measure outcome attainment [5].

The International University of Business Agriculture and Technology (IUBAT) is the first non-government university in Bangladesh, established by Prof Dr. M Alimullah Miyan in 1991, possessing the mission of 'human resource development'. Over the last three decades, the university has developed and currently running a graduate program master of business administration (MBA) and multiple undergraduate programs-bachelor of business administration (BBA), Tourism and Hospitality Management, Agriculture, Nursing, Economics, Computer Science and Engineering (CSE), Electrical and Electronics Engineering (EEE), Civil Engineering, Mechanical Engineering, and English. The College of Business Administration (CBA) is holding the mission 'to produce up-to-date, assertive, and effective business leaders and executives, entrepreneurs, as well as researchers' and currently, offers majors in Marketing, Finance, Accounting, and Human Resource Management in undergraduate (BBA) and graduate (MBA) program.

The International University of Business Agriculture and Technology has initiated OBE since 2015 but it was being implemented from 2018. Specifically, BBA program has redesigned OBE curriculum because department has realized and believed in an educational system that focuses and organizes outcome-based learning experiences on what the students are expected to be able to learn and act as well during the educational experiences. This needs for students a clear set of knowledge and skills relevant to course and program outcomes (PO) that students are expected to learn following graduation. According to OBE, the outcomes needs to be articulated in observable, behaviorist, cognitive terms on a sociocultural perspective [6]. Course instructors, curriculum designers, and program directors need to effectively assess whether or not they are successfully educating future professionals through their courses and programs, which is a core purpose of assessment [7].

This paper discusses direct assessment tool that has been developed by the college OBE trainer (the lead author of this article) to measure the OBE performance of course outcomes (CO) and PO of each course for bachelor's degree program. The rest of the paper is organized as: the next section discusses on the current OBE implementation based on the bachelor's degree program offered by CBA. The different sections of this paper are organized in the following sequences as the background, literature review, method, and assessment tool used to measure the course learning outcomes (CLO) of bachelor's degree program. Finally, the paper identified and presented future works with conclusion in the last section.

2. BACKGROUND

Currently, in BBA program there are four categories of courses such as general educational, core, specialization, and elective courses. These courses have been considered to measure the set of program outcomes represented in Table 1, including course learning outcomes. Then, the table shows one of the BBA specializations courses that has been mapped with the program learning outcomes (PLO).

Table 1. Mapping of CLO to PLO

	PO1	PO2	PO3	PO12
CLO1: define international financial institutions such as world bank, IMF, and ADB	√			
CLO2: explain exchange rate behavior in the FX markets	√			
CLO3: apply PPP, IRP, and IFE theories for international trade				√
CLO4: analyze foreign direct investment to establish subsidiaries in foreign countries		√		
CLO5: evaluate exchange rate risk management in the derivative markets			√	

The course learning outcomes represented in the Table 2 are considered to measure knowledge and skills required for all students to be able to do at the end of the course. This course has five course outcomes including two domain, namely cognitive and psychomotor skills. Using direct assessment tools (quizzes, assignment, presentation, and exams), students' learning and skills will be measured. The result attained will provide an indicator on course outcomes achievement while the program outcomes would give the generic skills at the time of graduation. Additionally, the feedback will be taken from the relevant stakeholders and considered for PO analysis [8]–[11]. The COs should be assessable and observable that should reflect the selected domains such as cognitive and psychomotor.

From the literature, there are two types of assessments, direct assessment, or indirect assessment. In assessing and evaluating the CO attainment, this study considers direct assessment used to measure the CO and PO. This self-developed assessment tool using Microsoft Excel has been applied for this automating evaluation. There is five CO that describe on what a student should learn during the semester and at the end of the course. Whereas PO describe on what students are expected to be able to attain and perform at the time of graduation while considering two domains such as psychomotor and cognitive skills, knowledge, and attitude. This CO and PO analysis tool has been developed in 2021 and used to measure attainment of CO.

The self-developed tool has five sections such as matrix CLO-PLO, CLO analysis, PLO analysis, report and continual quality improvement (CQI).

Table 2. Program learning outcomes

PO#	Domain	Skills
1	Business knowledge	Cognitive
2	Problem analysis	Cognitive
3	Design and applications	Psychomotor
4	Information and communication technology	Psychomotor
5	Modern tool usage	Psychomotor
6	Leadership	Affective
7	Sustainability	Affective
8	Ethics	Affective
9	Teamwork	Psychomotor
10	Communication	Psychomotor
11	Project management	Psychomotor
12	Lifelong learning	Affective

3. LITERATURE REVIEW

An outcome-based education is a performance oriented model with the core idea of defining the end product [12]. In OBE the focus of teaching moved from traditional teacher goals to student learning outcomes [13]. It is a teaching and learning strategy that focuses on outcomes of knowledge, competence, and orientation [14]. The precisely indicated outcomes of OBE provides clarity in teaching and learning direction [15]. The outcomes to be achieved are of three areas-cognitive, affective, and psychomotor of every single student of related subjects [16].

It has been observed that OBE is a significantly helpful technique for improving the performance of students. According to Akir, Eng, and Malie [17], the students who follow OBE based structure are more active learner with better results comparatively to those following conventional learning structure. The OBE based assessment basics need to be clear, measurable, achievable, and realistic for effective evaluation [18]. Therefore, continuous training is required for the faculty members to develop the concept and confirm the implementation of OBE [19]. The outcome of education is portrayed by the competencies developed in students after completing the program or course. LOs are things that learners will be able to perform as a result of education. At their micro level, LO are conceived as CO [20]. There are four major categories of outcomes named-CO, PO, program specific outcome (PSO), and program educational objective (PEO). CO-CO refers to statements that say what a student should be able to do after the completion of the course.

PO are considered to be the heart of OBE that expresses the attributes of graduate profile [21]. PO-program objectives are the set of objectives of a certain program about the attributes of a student based on knowledge, skills, and attitudes; approved by accreditation bodies of specific countries. For getting the advantages of OBE, many types of teaching methods are used including lectures, assignments, PowerPoint presentations, case studies, quizzes, group discussions, project work, industrial visits, seminars, guest lectures, and workshops [22]. Every course is designed with a set of CO. Course outcomes are also mapped to the different PO of the program. Through the continuous internal evaluation of CO, it is possible to measure the PO attainment which leads to the attainment of PEO. This attainment report can also help to revise PO, PEO, and even the mission and vision of the institute [23]. The attainment of CO and PO indicated the success of any program [24].

Assessed PO which is the expected achievement of the graduate attributes, knowledge, skills, and attitudes required for all students at the time of their graduation [25]. The business school of IUBAT has established 12 POs for all bachelor's degree courses from semesters 1 to 12. The measurements of the CO and PO are considered several assessment instruments such as quiz, assignment, presentation, first and mid exams, and final exam. The estimated PO results using PO matrix for one semester of fall 2021 and their sample included 27 students. The results revealed highest and lowest values between 60-96%. Similarly, Mutalib *et al*. [26] examined the same using direct method 2005/2006.

Research by Mohamad *et al*. [9] applied PLO and CLO, measured, and analyzed attainments of PLO and CLO using direct assessment tool. Rahman and Abdullah [10] studied CO for the course of mechanical design of year 3 taking sample of 58 students and using direct and indirect methods (indirect method was applied using questionnaire and Likert scale) and assessment instruments used quiz, exams, and project. Therefore, the indirect method may have benefits as an instructional tool [27]. It can also be useful for continuous improvement of the program [28]. Ahmad, Ali, and Zainudin [8] examined CLO using indirect (instrument for this was questionnaire in a Likert scale) method and direct method for assessment results with Rasch model for performance measurement. CO are framed based on both cognitive and psychomotor skills.

4. RESEARCH METHOD

The research type is quantitative where numerical data have been collected from a selective course and then analyzed using self-developed outcome-based education assessment software. The method of sampling technique is purposive because the entire population (total students in a class of fall 2021 under international finance course) has been considered as the survey has a set of characteristics of assessing five levels of cognitive domain (CO1-CO5). In this section, three components have been used for the analysis of outcomes (CO and PO).

First, the Bloom taxonomy domain has identified such as cognitive and psychomotor and each question paper has been mapped with CO and PO for assessment [29]–[32]. The test specification on CO is established and the data classifications based on the tabulation students' assessment results on each CO is formulated. Then data were transformed to the dataset that based on grade rating of mark cluster. The transformed data has been treated as input into Excel sheet [8]–[11]. Table 3 shows one of the taxonomy domains which is cognitive, and it has five levels under a bottom-up approach such as remember, understand, apply, analyze, and evaluation. Each level is mapped across PO which is known as assessment criterion.

Table 3. Relationship of direct assessment with dedicated CLO for international financial management

Assessment instruments	CO1	CO2	CO3	CO4	CO5
Quiz: quizzes have been assessed on levels two, three and four		√	√	√	
Assignment: assignment has been assessed on level two		√			
Presentation: presentation has been assessed on level two		√			
Exam 1: exam 1 has been assessed on level two, three, and four		√	√	√	
Exam 2: exam 2 has been assessed on level two, three, and four		√	√	√	
Exam 3: exam 3 has been assessed on level one, two, and four	√	√		√	

This section starts with the identification of the research domain. International Financial Management (FIN405) course has been chosen for research domain and the CLO for this course has been examined. In brief, the course has an aim to teach students on the expert system by using an expert system development life cycle. The developments of the CLO for this course are according to Bloom taxonomy level as shown in Table 2. Bloom taxonomy cognitive learning levels which are knowledge, understand, apply, analyze, evaluate and synthesis are applied to CLO of the course. The assessment comprises of quizzes (5%); assignments (10%); presentation (10%); and the first, mid, and final exams (75%).

The results obtained from FIN405 course assessment will be used to illustrate each section in CLO analysis. The key performance indicators (KPI) stated minimum target/goal set for a specific assessment. The KPI set by the department is at least 70% of the students achieve at least 70% for each CLO. As stated in the Table 2, there are five CLO need to be achieved towards the completion of the course. In this section cognitive domain and its levels have been applied up to level five where level one for remember, two for understand, three for demonstrate or apply, four for analyze and five for evaluation.

5. RESULTS AND DISCUSSION

The results have been analyzed using CLO-PLO matrix are described in Table 4. In the matrix of CLO-PLO analysis, information of the student's assessment entered with an appropriate weight to measure the CO and PO attainments that is aligned with two taxonomy domains of cognitive and psychomotor. As presented in Table 4, the cognitive domain for CLO of FIN405, which is assessed based on quiz, assignment, presentation, exams (1 and 2), and final exam that carry 5%, 10%, 10%, 20%, 20%, and 35% weightage.

The cognitive domain for CLO#1, CLO#2, CLO#3, and CLO#5 for the course is evaluated using the same approach. In Figure 1, assessment results have been reflected where a total of 26 students from 27 students have achieved the target set for the cognitive domain (96.30% for CLO#1, 85.19% for CLO#2, 77.78% for CLO#3 and 62.96% for CLO#5), and psychomotor domain (66.67% for CLO#4). From the results, it is cleared that CO have been attained over the KPI set by the department.

The CO attainments for each of the CLO are recorded by the respective course instructor which is represented in Table 5. In this table, an achievement for each of the students shown where total number of students are 27 out of which 26 students got above 70% in CLO#1, 23 students got above 70% in CLO#2, 21 students got above 70% in CLO#3, 18 students got above 70% in CLO#4, and 17 students got above 70% in CLO#5. These results also reflect whether the students reached the threshold or not. On average, level 5 has not met the threshold but there are a few numbers of students who met the threshold.

Table 4. CLO–PLO matrix

Student ID	Assignment			Quiz		First-term				
	PO2	PO12	PO1	PO2	PO2	PO1	PO1	PO2	PO2	PO3
	CO3	CO2	CO2	CO3	CO4	CO2	CO2	CO3	CO4	CO5
	Q1	Q1	Q1	Q2	Q3	Q1	Q2	Q3	Q4	Q5
	100	100	50	25	25	20	20	20	20	20
21304001	94	90	40	25	20	20	18	16	10	12
21304002	85	91	46	19	20	12	19	15	19	15
21304003	95	90	39	16	14	15	14	14	15	15
21304004	90	65	20	25	21	20	15	18	15	18
21304005	73	90	40	18	25	17	18	12	14	11
21304006	70	96	20	10	23	17	17	17	15	14
21304007	83	76	28	15	14	18	18	18	18	18
21304008	70	72	44	21	15	18	20	20	17	15
21304009	99	90	20	19	19	17	16	16	20	17
21304010	77	90	45	10	25	17	16	18	12	12
21304011	95	90	44	25	18	18	18	18	15	15
21304012	92	64	20	14	10	20	20	16	17	11
21304013	85	92	36	21	17	20	15	15	20	12
21304014	79	86	40	12	11	19	20	15	17	12

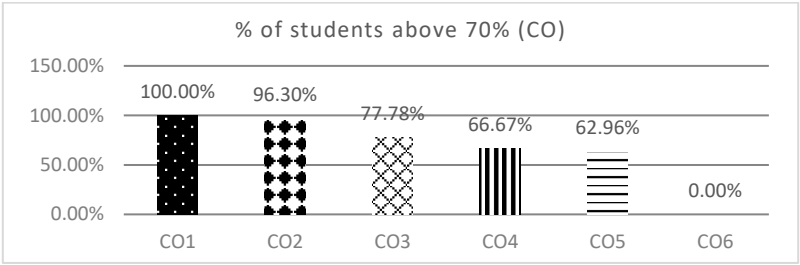

Figure 1. Overall CLO achievement

Table 5. Overall CLO achievement for FIN405

Student ID	CO1 (%)	CO2 (%)	CO3 (%)	CO4 (%)	CO5 (%)
21304001	89.29	87.69	81.54	69.23	75.00
21304002	92.14	83.85	78.46	83.08	67.00
21304003	86.43	76.92	73.85	69.23	75.00
21304004	70.00	70.00	93.85	76.92	74.00
21304005	84.29	86.92	70.77	86.15	82.00
21304006	94.29	66.15	61.54	84.62	61.00
21304007	80.00	77.69	78.46	76.92	83.00
21304008	75.00	89.23	90.77	72.31	79.00
21304009	85.71	67.69	81.54	80.00	86.00
21304010	89.29	85.38	70.77	76.92	69.00
21304011	87.86	83.85	86.15	76.92	79.00
21304012	67.14	75.38	76.92	67.69	67.00
21304013	90.71	80.00	70.77	80.00	76.00
21304014	82.14	89.23	69.23	63.08	67.00
21304015	96.43	80.77	72.31	69.23	72.00
21304016	90.71	66.92	72.31	73.85	67.00
21304017	86.43	70.77	70.77	92.31	68.00
21304018	90.00	69.23	76.92	58.46	71.00
21304019	97.86	85.38	70.77	63.08	68.00
21304020	87.86	86.15	63.08	63.08	74.00
21304021	89.29	90.00	81.54	86.15	77.00
21304022	81.43	91.54	64.62	70.77	76.00
21304023	90.00	89.23	70.77	67.69	69.00
21304024	88.57	87.69	73.85	72.31	71.00
21304025	87.86	70.00	92.31	84.62	77.00
21304026	88.57	84.62	64.62	76.92	68.00
21304027	87.86	73.08	66.15	78.46	81.00
Total CO achievement	96.30 (Pass)	85.19 (Pass)	77.78 (Pass)	66.67 (Fail)	62.96 (Fail)

5.1. Continual quality improvement

CQI is a tool used to identify the key parameters required for the student's assessment to provide better outcomes and make them more relevant to the employer's requirements. CQI can influence academic motivation levels which ensures the achievement of students' goals [33]. In addition to that, the CQI also

motivates the students to succeed [34]. The instructor of the course must identify them and consider further suitable actions in the next implementation of the course. The recommendation is to improve the quality of CO, PO, and PEO according to targeted KPI [8]–[11]. The CQI is proposed after discussion with the instructor of the respective course and suggestions are taken on both CO of above and below KPI meaning that those outcomes above KPI must continue for improvement as well as those of which are below KPI should address for continuous improvement. This is shown in Table 6.

The study has found the CLO achievement in bachelor's degree course above threshold, which is 70% and that's for CLOs 1, 2, and 3. However, students did not achieve CO up to threshold and for levels 4 and 5 under cognitive domain. Similarly, Mutalib *et al*. [26] examined the same using direct method 2005/2006. Most recent studies found by Mohamad *et al*. [9] who applied PLO and CLO, measured, and analyzed attainments of PLO and CLO using direct assessment tool. Research by Rahman and Abdullah [10] studied CO for the course of mechanical design of year 3 taking sample of 58 students and using direct method and assessment instruments used quiz, exams, and project. CO are framed based on both cognitive and psychomotor skills. Our results are supported by the research who applied same method that we did.

What we objectively tried to measure is student's learning outcomes and expected achievement of the graduate attributes of knowledge, skills, attitudes which are supported in the most recent study by Arshad, Razali, and Mohamed [25] who assessed PO which is the expected achievement of the graduate attributes, knowledge, skills, and attitudes required for all students at the time of their graduation. Therefore, using direct method to measure students' performance helps in finding the gap and applies corrective measure to address the gap for future students. This method helps to improve students' performance and achieve expected learning outcomes for students at the time of graduation.

Table 6. CQI section in PLO analysis tool

CQI	Outcomes					Improvement plan
CQI for CLO1	Additional classes	Additional exercises **(√)**	Different delivery approaches	Specific tips in answering	Self-assessment	Due to the nature of the course which uses economic analysis skills, teaching style should be applied in macro and microeconomics.
CQI for CLO2	Additional counseling	Additional assignment	Special observations	Specific tips in answering	Self-assessment **(√)**	For this CLO, students should work on a team and make group discussion to go deeper into the topic. Sometimes, instructors may take self-assessment of the students and improvement as well.
CQI for CLO3	Additional classes	Additional exercises	Different delivery approaches **(√)**	Specific tips in answering	Self-assessment	Due to the nature of the course, instructors may give different delivery approaches to make them equip in the applications of theories and models in the course.
CQI for CLO4	Additional classes	Additional exercises	Different delivery approaches	Specific tips in answering **(√)**	Self-assessment	There are many models applied mathematically in this course and students are from diverse background (i.e., sciences, and business) and instructors may arrange special session for tips and tricks that can be applied and by using of which students can easily learn regardless of their background.
CQI for CLO5	Motivational sessions	Special seminar	Additional skills development	Special counseling session **(√)**	Direct feedback	Students are supposed to be at most senior level while doing this course and must have completed all major courses in Finance to equip with this course. Students must know that they have a very good knowledge in macroeconomics before taking this course. Thus, special counseling is required.

6. CONCLUSION

The study conducted on teaching and learning assessment considering a class of 27 students under International Finance during the fall 2021. Overall, five levels of cognitive domain have been applied while teaching in the course and students were assessed using quizzes, assignment, presentation, and exams under outcome-based education where significant number of students have reached the threshold which is 70%. Their learning was excellent in terms of the course content, and they will be able to apply it in their practical field once they come graduated. In order for continuation of teaching and learning, continual quality improvement is important in the future semesters. In mechanizing the continual quality improvement, the department would consider inputs from stakeholders and accreditation bodies. Department would also conduct program self-assessment with respect to teaching learning assessment of the bachelor's degree program.

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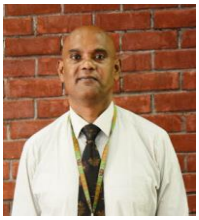

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