

*The Development of Assessment Process for Undergraduate Students'
Learning Outcomes According to OBE Model*

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Abstract

The outcome-based education (OBE) focuses on an articulated idea of what skills and knowledge the students need to have after learning in course, especially used for occupation. The academic programs in university were designed and continuously improved for up to date according to the stakeholders' requirement before offering to students. Examination or post-test generally is a method for student assessment by evaluating abilities and achievements in every classroom to analyze the effective teaching. This case study showed the development process of learning outcomes assessment for 45 and 55 undergraduate students of 1st year and 2nd year by setting an activity as exhibition model for creative work called "Yearly Micro-Project" in the program of Packaging and Printing Technology, King Mongkut's University of Technology Thonburi, Thailand. For the 4-year curriculum, the year learning outcomes (YLO) of undergraduate students were set to assess KSA (Knowledge + Skills + Attitude) after the end of each academic year. The students gathered all knowledge to create works according to the problems specified by the instructors for presentation of their design and production process for printing and packaging materials. An assessment with Microsoft Forms of rating criteria (Rubric score) on 5-level was created for assessors who attend the exhibition activity could easily give the scores to each student. The advisors followed up on the progress of their work, collecting assessment results and summarizing student learning outcomes. The satisfaction of students and teachers for this project were evaluated, indicating that this learning outcome assessment method was very appropriate.

Keywords: Outcome-Based Education, Year Learning Outcome, Rubic Score

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Introduction

The traditional education system for higher education which focuses on scoring good marks rather than learning actual skills or gaining practical knowledge, is outdated. Presently, to avoid the problem of unemployment for the graduated students, the university needs to switch to an outcome-based education (OBE) system that focuses on the actual outcome of the course and not just grades [1]. The King Mongkut's University of Technology Thonburi (KMUTT) has been working to meet the standards set by the Ministry of Higher Education, Science, Research, and Innovation, Thailand to enhance the quality of education, research, and innovation by improving teaching and learning processes by implementing OBE principles. The academic staff then develop their courses by applying technology, innovation, and new teaching methods to develop students' learning outcomes and assessment tools. The OBE focuses on an articulated idea of what skills and knowledge the students need to have after learning in course, especially used for occupation. The traditional student assessment methods had been generally examination or post-test to evaluate the achievements of teaching and learning.

The curriculums of all academic programs in university had to be continuously designed and improved for up to date according to the stakeholder requirement every 4 years. Since the curriculum of Bachelor of Science program in Packaging and Printing Technology at KMUTT was improved in the academic year 2022, a new assessment process of undergraduate students learning outcomes has been applied. After the Program Learning Outcomes (PLO) were established, the Year Learning Outcomes (YLO) according to the PLO was issued for assessment in terms of knowledge, skills, and attitudes (KSA) based on the principles of OBE and followed the Backward Design. The constructive alignment approach was applied to ensure the achievement of learning outcomes as expected which were assessed using a 5-level score based on holistic rubrics following Bloom's Taxonomy [2] for a comprehensive evaluation, as Figure 1.

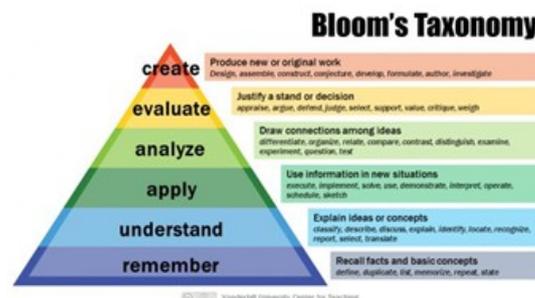


Figure 1: Bloom's Taxonomy Learning Theory

To test the effectiveness of the OBE assessment system, the first year and the second-year undergraduate students were individual evaluated with a 5-level score rubric using Microsoft Forms by the instructors of the program through the student's work as assignment. This activity of work presentation to evaluate as YLO was organized as an exhibition namely "Yearly Micro-Projects" where the students applied their knowledge in an academic year (2 semesters). The advisors of the students who explained the assignments, had to follow the work progress, summarize their learning outcomes from the assessment results, and gave feedback to help students improve their learning experience. After completing the activities, the information of opinions and satisfaction of the students and instructors to the Yearly Micro-Project activities were collected using Microsoft Forms for further improvement.

Methodology

Designation of Learning Outcome Assessment

The research methodology for the development of a learning outcome assessment for 45 first-year undergraduate students and 55 second-year undergraduate students in the Packaging and Printing Technology program. The “Constructive Alignment” concept was used as a technique to develop the students and learning activities to achieve the goal, which refers to the "triangle of learning"[3], as Figure 2.

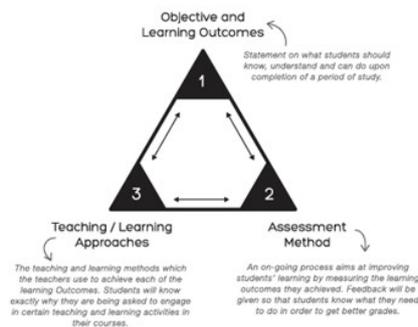


Figure 2: Constructive Alignment Concept

In this program specification, the learning outcome (LO) is carried out according to the principle of backward design and distributed to each subject by providing the course learning outcome (CLO) in alignment with the OBE concept, which contain 1-2 topics and begin with a verb, as shown in Table 1 and 2. The student learning outcomes stated what students are expected to know or be able to do upon completion of a course or a program, which should be clear, observable and measurable, and reflect what will be included in the course requirements (assignments, exams, projects, etc.). In addition to assessment for each subject, the yearly student learning outcomes as the requirement are shown in Figure 3, which could be assessed from the project results that they applied the integrated KSA of all subjects in an academic year of 2022.

Semester/ Academic Year	Course	Instructor	Course Learning Outcome (CLO)
1/2022	Basic Packaging and Printing	A, B	<ol style="list-style-type: none"> 1. Identify the printing systems suitable for print and packaging production. 2. Identify the packaging types and select appropriate packaging for the products.
1/2022	Drawing and Photo for Packaging and Printing	C	<ol style="list-style-type: none"> 1. Create the proper three-dimensional model of packaging. 2. Select appropriate graphics for the project concept.
1/2022	Layout design	C	<ol style="list-style-type: none"> 1. Choose a proper software for printed product design. 2. Use a proper layout for graphic composition.
2/2022	Basic science for Packaging and Printing	D	<ol style="list-style-type: none"> 1. Identify the types of solvents and polymers used in packaging and printing. 2. Identify the types of microorganisms.
2/2022	Prepress process	C, E	<ol style="list-style-type: none"> 1. Prepare files compatible with the printing system.

Table 1: Examples of Course Learning Outcomes (CLO) for the first-year undergraduate students

Semester/ Academic Year	Subjects	Instructor	Course Learning Outcome (CLO)
1/2022	Printing ink	D	1. Choose the proper printing ink type for the printed products. 2. Test the basic properties of the printing ink.
1/2022	Glass and Metal	F	1. Compare and choose proper glass and metal substrates for application. 2. Test the basic properties of glass and metal substrates.
1/2022	Paper and Wood	A	1. Select the appropriate paper types for packaging use. 2. Make the paper packaging and test the basic properties.
1/2022	Offset printing	B	1. Choose the proper substrates for offset printing. 2. Produce printed products with the offset printing system.
2/2022	Packaging Design	C, G	1. Design the proper packaging correctly.
2/2022	Color Management System	F	1. Create a color profile for the printing. 2. Set the color management system.
2/2022	Post press process	H	1. Choose the proper technique for post-press.
2/2022	Digital printing	D	1. Choose the proper digital printing system. 2. Inspect the print quality of digital printing.
2/2022	Screen printing	E	1. Produce the printed products with screen printing system.

Table 2: Examples of Course Learning Outcomes (CLO) for the second-year undergraduate students

PACKAGING & PRINTING TECHNOLOGY YEAR LEARNING OUTCOME	
1	Explain the phenomena that occur in packaging and printing design using scientific principles.
2	Apply scientific knowledge and technology in the production of packaging and printed materials.
3	Develop packaging and printing to meet the needs of the industry.
4	Analyze and systematically address issues related to packaging and printing, taking into consideration industrial scientific processes.

Figure 3: Year Learning Outcomes (YLO) of the Printing and Packaging Technology Program for the first, second, third, and fourth academic year

To effectively evaluate the YLO of the students, the activity process for the project presentation was designed to be carried out in a short time. The assessment tools were then

created by applying the learning theory of Bloom's Taxonomy to measure the learners' level of learning. Before the simulated exhibition for the students' project was organized to show the evidence of learning outcome, the students had to submit their works to the program administrators, as the list in Table 3.

1st Year Student	2nd Year Student
- work file in pdf	- project report (A4)
- sample of packaging selected	- poster (A3)
- project report (A4)	
- poster (A3)	

Table 3: The evidence for submission to present the students learning outcomes

Creation of Assessment Form

The assessment tools were conducted using a Holistic Rubric format [4], which means that the assessment criteria are not separated for each subject but are evaluated as a whole work results. The assessment tools using the Microsoft Forms with 5-level rating score system (level 1: very poor to level 5: very good) with a total weighted score of 100%, which would impact the student's grades. The assessment topics were based on the completion of individual student projects that were assigned to them. In this process, the instructors evaluated all students in knowledge, skills, and attitudes (KSA) because they had to apply their knowledge acquired from all subjects for one academic year to create and present their projects as required. The CLO of each subject was assessed by the subject instructor, while all instructors in this program had to assess the overall qualities from the project work as assignment, as shown in Table 4 and 5.

Subjects	Course Learning Outcome (CLO)	Weight	Assessment Criteria (Rubric Score)				
			1	2	3	4	5
Printing ink 1/2022	1. Choose the proper printing ink type for the printed products.	60%	Choose the wrong printing ink types.	Unable to explain the properties and usage of the printing ink.	Able to choose and explain the usage.	Able to choose and explain the printing ink components.	Suggest the printing ink development.
	2. Test the basic properties of the printing ink.	40%	Unable to know tools and methods for printing ink test.	Using the wrong tools and test methods to meet the requirement.	Using the right tools and test methods to meet the requirement.	Explain the results of property test.	Suggest the printing ink property development.
Digital printing 2/2022	1. Choose the proper digital printing system.	50%	Choose the wrong digital printing systems.	Choose the right digital printing systems.	Able to explain the digital printer and digital printing production.	Able to solve the printing problems appropriately.	Suggest the digital printing improvement.
	2. Inspect the print quality of digital printing.	50%	Unable to know the digital printing quality inspection.	Choose the wrong method of printing quality inspection.	Choose the right method of printing quality inspection.	Able to explain the printing quality inspection.	Suggest the solutions of printing problems.

Table 4: Examples of CLO assessment for each subject using a Holistic Rubric

1	2	3	4	5
The work was not beneficial and tends to impact the community, society, environment, etc.	The work was not suitable for use or is incorrect.	The work was created with the appropriate knowledge of packaging and printing.	The knowledge of packaging and printing was correctly applied with the creative thinking.	The work was commercially benefit for community, society, environment, etc.

Table 5: The criteria for overall qualities of work assessment with the Holistic Rubric of 5-level scoring scale

Organizing of Activity for Learning Outcome Assessment

The activity for learning outcome assessment was organized to enhance the process of OBE. The students should incorporate knowledge (K), skills (S), and attitudes (A) as fundamental of learning to create the project assigned by the instructors. The students had to create their projects aligned with the expected Year Learning Outcomes (YLO) and presented in the event as an exhibition called 'Yearly Micro-Project', and the process was carried out sequentially, as shown in Figure 4.

The qualities of student’s project work, presentation, and answering ability that indicate their learning outcomes were assessed personally by the instructors, academic staffs, and supporting staffs. Before the event occurs, the year advisors of students must meet with the students to explain the project requirement details. The students should present their projects to the assessors by applying their knowledge acquired for one academic year (2 semesters), as shown in Figure 5.

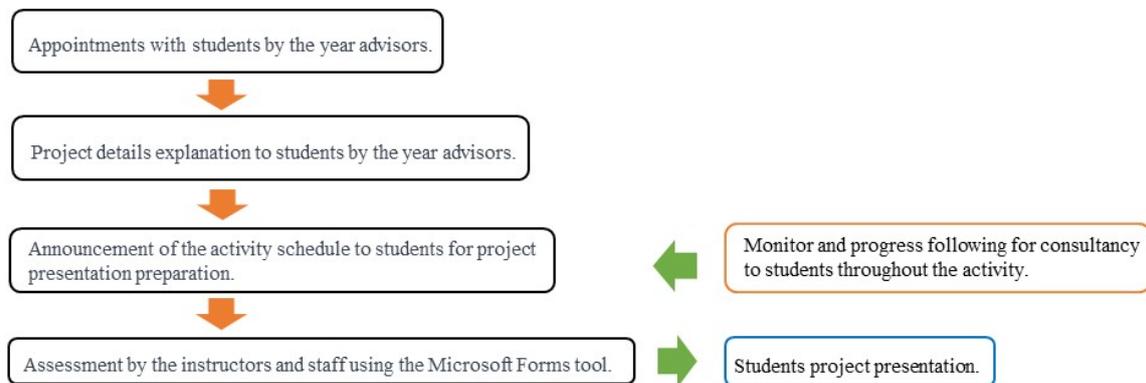


Figure 4: A diagram illustrating the process steps of Yearly Micro-Project activity



Figure 5: The event of Yearly Micro-Project Activity

Assessment of Student Learning Outcomes

In the assessment process of the learning outcomes of the first-year students and the second-year students, the project work was individually shown and presented to the assessors. After that, the assessors gave the score in the Microsoft Form, determined from the qualities of presentation and the work results, according to various aspects as follows:

1. Creativity of the work
2. Skills and abilities in different subjects
(ex. packaging and printing, science, English language proficiency, etc.)
3. Intellectual aspects (ex. thinking, planning, problem-solving)
4. Responsibility and ethics in the work

The assessors were divided into two groups for two parts of the assessment process through the Microsoft Forms tool. The subject instructors should assess the learning outcome of the students in their course after completing the classes. In addition, the instructors and supporting staff in the program of Packaging and Printing Technology assessed the overall qualities of the students' work. The average total scores calculated from assessment and weighted scores from all parts from all assessors were interpreted to grade level, as Table 6.

Score Range	Interpretation	Grade
3.75 – 4.00	Excellent	A
3.25 – 3.74	Very good	B+
2.75 – 3.24	Good	B
2.25 – 2.74	Fair	C+
2.00 – 2.24	Poor	C
< 2.00	Very poor	I (incomplete)

Table 6: Interpretation of score range into grade

The administrators of this program set out the criteria for the expected score assessed from the students learning outcome as follows:

1. The score range for the excellent and very good is above the criteria as expected.
2. The score range for the good level is the criteria as expected.
3. The score range under the criteria as expected are the fair and poor level which should be concerned for improvement.

More than 80% of the total undergraduate students should be at the level of good, very good and excellent. However, the students with an average score of more than 2 will be considered to have passed the course with the lower grades while the students with an average score less than 2 will not pass and must present again by improving their works within one year later.

Evaluation of Satisfaction

The evaluation of satisfaction towards the activity of Yearly Micro-Project through the Microsoft Forms tool was also performed by all involved students, instructors and supporting staff. The online questionnaire for satisfaction evaluation in 5-level rating scale [5] on the topics in Table 8 was sent to the activity participants after completing the activity. The obtained scores from the respondents were classified and interpreted in the range as shown in Table 7. The opinion expression was also included in the open-ended questionnaire for further consideration of activity process improvement.

Range of Satisfaction	Interpretation
4.51 – 5.00	Very satisfied
3.51 – 4.50	Somewhat satisfied
2.51 – 3.50	Neutral
1.51 – 2.50	Somewhat unsatisfied
1.00 – 1.50	Very unsatisfied

Table 7: The interpretation for satisfaction evaluation results from 5-level rating scale

Evaluation Topics	Sub-topics
Activity Management	<ul style="list-style-type: none">- Activity announcement- Notification of information- Duration of the event- Schedule of the event
Activity Format	<ul style="list-style-type: none">- Presentation style- Evaluation method
Activity Venue	<ul style="list-style-type: none">- Suitability of venue
Obtained Benefit from the Activity (students only)	<ul style="list-style-type: none">- Knowledge, ideas, skills, and experiences from this activity- Application to your studies or practical work.- Accordant to your expectations
Overview of Activities	-

Table 8: The contents in questionnaire for satisfaction evaluation

Research Results

The Learning Outcome Assessment of the Students

After the students' learning outcomes of each subject were assessed by the instructors, the number of students in each grade was identified to determine the teaching and learning achievement, as shown in Table 9.

Subjects	Number of students in each grade from CLO								Mean	S.D.
	A	B+	B	C+	C	I	Level as Expected	Pass		
Basic Packaging and Printing	0	11	25	4	3	2	80.00%	95.55%	2.88	0.73
Drawing and Photo for Packaging and Printing	10	11	13	1	1	9	75.55%	80.00%	3.35	0.99
Layout Design	17	7	12	1	0	5	80.00%	82.22%	2.71	1.44
Basic Science for Packaging and Printing	2	0	2	7	8	26	8.88%	42.22%	1.85	0.88
Prepress Process	32	0	2	0	1	10	75.50%	77.78%	3.71	2.05

Table 9: The assessment of year learning outcomes of 45 first year students

Table 9 shows that the subject of Prepress Process had the greatest number of excellent students (71.11%) who got grade A, mean value = 3.71, S.D. = 2.05. The subject of Basic Packaging and Printing had none of excellent students, mean = 2.88, S.D. = 0.73, indicating that the subject instructor should find the tools to improve the learning activity and outcomes. Two subjects were achieving the criteria of student number getting the expected level (80%) and other two subjects almost met the criteria (around 75.5%), while only one subject was not achieved. The subject of Basic Science for Packaging and Printing had the greatest number of students not pass (grade I), indicating that the subject instructors should improve their teaching methods to enhance the learning outcome of many students.

Subjects	Number of students in each grade from CLO								Mean	S.D.
	A	B+	B	C+	C	I	Level as Expected	Pass		
Printing ink	12	0	20	0	13	10	58.18%	81.81%	2.94	1.32
Glass and Metal	12	22	4	0	14	3	69.09%	94.54%	3.22	0.79
Paper and Wood	14	15	16	2	4	4	81.81%	92.73%	3.36	0.61
Offset printing	2	7	41	1	0	4	90.91%	92.73%	3.05	0.51
Packaging Design	14	26	10	1	0	4	90.91%	92.73%	3.48	0.65
Color Management System	9	0	33	0	10	3	76.36%	94.54%	3.02	0.70
Post press process	10	0	22	0	18	5	58.18%	90.91%	2.80	0.78
Digital printing	8	0	8	0	34	5	29.09%	90.91%	2.42	0.80
Screen printing	0	0	41	0	10	4	74.55%	92.73%	2.75	0.56

Table 10: The assessment of year learning outcomes of 55 second year students

Table 10 shows that the subject of Screen Printing had none of excellent students getting grade A, mean = 2.75, S.D. = 0.56. Four subjects had the highest number of excellent

students (22-25%) who got grade A. There were three subjects meeting the criteria of student number getting the expected level (>80%) and two subjects almost meet the criteria (around 74-76%), while 4 subjects were not achieved, which should be found the tools to improve the learning outcomes.

Score Range	Interpretation	Student Number	Ratio (%)
3.75 – 4.00	Excellent	16	35.55
3.25 – 3.74	Very good	15	33.33
2.75 – 3.24	Good	3	6.67
2.25 – 2.74	Fair	4	8.88
2.00 – 2.24	Poor	2	4.44
< 2.00	Very poor	2	4.44
Total		45	

Remark: Mean score = 3.45, S.D. = 0.72

Table 11: The interpretation of the Year Learning Outcomes for the first-year undergraduate students

Table 11 shows that the overall scores for 68.88% of total students, more than half, were higher than the mean score, indicating that the learning outcome level was higher than the expected level, while 31.11% of total students got a score below the mean value.

Score Range	Interpretation	Student Number	Ratio (%)
3.75 – 4.00	Excellent	19	34.54
3.25 – 3.74	Very good	31	56.36
2.75 – 3.24	Good	1	1.81
2.25 – 2.74	Fair	0	0
2.00 – 2.24	Poor	0	0
< 2.00	Very poor	4	7.27
Total		55	

Remark: Mean score = 3.42, S.D. = 1.00

Table 12: The interpretation of the Year Learning Outcomes for the second-year undergraduate students

Table 12 shows that the overall scores for 90.9% of total students almost all students were higher than the mean score, indicating that the learning outcome level was very higher than the expected level, while only 7.27% of total students got a score below the mean value. The results indicate that the second-year undergraduate students with more learning experience and KSA increase had more learning outcomes with higher competency than the first-year undergraduate students.

Evaluation of the Participants' Satisfaction on the Activity

The results of the satisfaction opinions for the activities in this session, evaluated by the participated students, instructors, and staffs are shown as Table 13.

Evaluation Topics	Evaluators		
	Students	Instructors	Staffs
Activity Management	4.22	4.67	4.06
Activity Format	4.24	4.67	4.13
Activity Venue	4.36	4.33	4.50
Obtained Benefit from the Activity (students only)	4.44	-	-
Overview of Activities	4.14	4.33	4.25
Mean	4.28	4.50	4.23
S.D.	0.12	0.19	0.19
Level Interpretation	Good	Good	Good

Table 13: The Evaluation of Satisfaction

From Table 13, the satisfaction survey regarding the organizing of this event, the results indicate that all participants, instructors, and supporting staff were satisfied at the good level. The amount of 72% of the total participants agree to set the activity as this event in the next year, while the other participants of 28% disagree to set this activity.

Conclusions

For the learning outcomes assessment of 45 first-year students from 5 subjects, it was found that one subject (Prepress Process) had the greatest number of excellent students while another one subject (Basic Packaging and Printing) had none of excellent students which should be improved by the subject instructor. Almost four subjects were achieved as the criteria of student number getting the expected level (75-80% of total students) while only one subject was not achieved. One subject (Basic Science for Packaging and Printing) had a high number of students not pass (grade I), indicating that the subject instructors should find the tools for this problem solving.

For the learning outcomes assessment of 55 second-year students from 9 subjects, one subject (Screen Printing) had none of excellent students getting grade A while four subjects had the highest number of excellent students (22-25%). There were three subjects that achieved the expected number of students getting accepted level and two subjects almost met the criteria while four subjects were not acquired, which should be further improved.

For the overall assessment, more than half (69%) of the first-year undergraduate students got higher average scores than the mean score, and almost all the second-year undergraduate students (91%) got higher average scores than the mean score.

From the evaluation of satisfaction on the activity, the participants, instructors, and staff, were satisfied with this activity with the rating scale range at the level of good.

From the opinion expression, 72% of total participants agree to set the activity continuously in the next year while the others of 28% disagree to set this activity.

Issues Encountered

Students should improve their readiness in preparing content for presentation. They should have more self-learning about the topics they have learned and ask for the information from

the instructors. Additionally, the project work should be continuously updated on the progress by prior present to their year advisors.

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