

# Improving Malaysian HE Knowledge Towards a Wood and Furniture Industry 4.0



## Deliverable 2.3: Methodological aspects

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Dissemination level: National, International

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## Partners

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P3	Karlsruhe Institute of Technology	KIT	GE
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## 1. Introduction

This document reports the results performed in task “**T2.3: Methodological aspects**” in the framework of the **WP2 “Training path, learning content structure and methodological aspects”**.

The aim of this task, leaded by KIT, is to define the best training methodology for Making 4.0 Master, approaching the current teaching methodology in Malaysia. To carry out this task, the European partners prepared a survey to collect the necessary information. The survey was conducted on 4/7/2019 during the 2nd meeting at WULS. The four participating universities were USM, UKM, UiTM and UPM. USM was responsible for carrying out the analysis of the results, which are compiled in the report "Survey about the Malaysian Teaching Methodology" (Annex 1).

In addition to the above-mentioned survey, some documents from the Malaysian Qualifications Agency, specified in the references, have also been taken into account in the development of this document. This ensures that the methodology to be used is in line with the Malaysian education system.

With the completion of this work together with the **D2.2 “Joint Curriculum”**, we have achieved **Milestone 3**: “Determine the best training methodology and path”. Moreover, this work is also linked to specific project objective **SO2**: “Create an innovative learning pathway able to provide HE students the most important competences and skills related with Industry 4.0.

The results of this report act as a support point for the correct development of the WP3: “Develop of Training Materials and guides for trainers”, as will set the basis for the development of the necessary training materials that will made up the Making 4.0 Master Degree.

## 2. LEARNING PATH AND TRAINING METHODOLOGY.

The learning path of the Master Degree is designed so that the students obtain the necessary knowledge in a progressive way, starting with courses on the technologies of the industry 4.0, deepening later with those more specific to the wood industry. The objective is to give the students the necessary tools to apply the benefits of the industry 4.0 in each of the processes of wood transformation until the final product is reached.

The Master Degree is structured to last one academic year (two semesters), and consists of four modules composed of 9 compulsory courses and 11 elective courses, 6 of the electives must be taken.

In addition, an internship and a master's thesis are required to complete the training program.

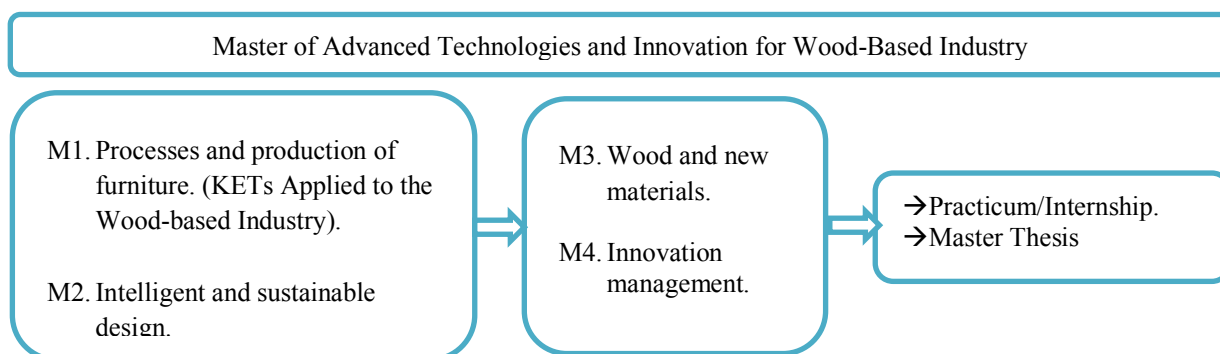


Figure 1. Structure of the Master MAKING 4.0 simplified.

For the assignment of Student Learning Time (SLT) in each of the courses, both the answers of the survey made to the Malaysian universities and the references of the Malaysian credit system have been considered. All courses are two Malaysian credits (3 European credits), and the entire master's degree has an allocation of 40 Malaysian credits (60 European credits)<sup>1</sup>.

In summary, the allocation of hours for all the courses of the Master's degree follow the table below.

Credit	Nature of the course	Total F2F hours (14 weeks)		*Total NF2F hours (14 weeks)	Total SLT
		Lecture	Practical		
2	Without Practical	28	0	52	80
2	With 3 hours Practical per week	14	42	24	80

Table 1: Student Learning Time by nature of the course. [1]

<sup>1</sup> Henceforth when it is expressed credits in this document it is referenced to Malaysian credits

Total SLT is counted based on the assumption of learning hours by topic in a course, which includes the guided learning activities both face-to-face (F2F) and non-face-to-face (NF2F), independent learning, as well as assessment hours.

The following table shows some of the guidelines that have been considered for the assumption on the allocation of student learning times (SLT) in each of the courses:

Learning Activities	F2F Learning Hours	NF2F Learning Hours
Lecture	1 hour per topic (total lecture hours per topic is depending on the depth of topics, and based on credit values)	1~2 hour
Tutorial	1 hour	1 hour
Practical	3 hours per week	3 hours per week
Studio	2 hours per week	2 hours per week
SCL: Problem-Based Learning	2 hours per activity	4 hours per activity
Group Discussion	1~2 hour per activity	1 hour per activity
Presentation	1 hour per activity	3~4 hours per activity
Formal Continuous Assessment	2 hour per assessment (depend on the level of difficulties)	2 hours for preparation
Formal Final Assessment	2 hours per assessment	3 hours for preparation
Assignment	1 hour per task (for one type of assessment)	2 hours per task
Preparation for Formal Assessments		(2 hours x total continuous assessment) + (3 hours for preparation of final assessment)
Revision		1 hour x total lecture hours

Table 2: Guideline for the assumption on allocation of student learning times (SLT). [2]

Table below show the examples for each type of student learning (F2F – NF2F):

Types of learning	Examples
Guided Learning: Face-to-face (F2F)	Lecture, tutorial, practical, studio work, Student-Centered Learning (SCL) activities such as case study, problem-based learning, project oriented based learning, presentation, group discussion, etc.
Guided Learning: Non-face-to-face (NF2F)	E-learning, Completion of any given tasks, modular learning, etc.
Independent Learning (NF2F)	Revision, preparation for assessments

Table 3: Examples of teaching methods by type of learning. [2]

Based on the total hours of Guided F2F, Guided NF2F and Independent learning, below shows how credit is determined:

Total Student Learning Time (SLT) per Semester (Total SLT for 14 weeks of learning)	Credit
40~43 hours	1
80~83 hours	2

Table 4: Total Student Learning Time (SLT) per credit. [1]

In order to define the best methodological aspects for the MAKING 4.0 Master Degree, we have had as reference the answers of the survey made to the four Malaysian universities. Specifically, the answers to the questions: What type of methodology are you using in your Lectures (F2F)? What type of resources are you using in your lectures (F2F)? and What type of assessment methodology are you using in your lectures?

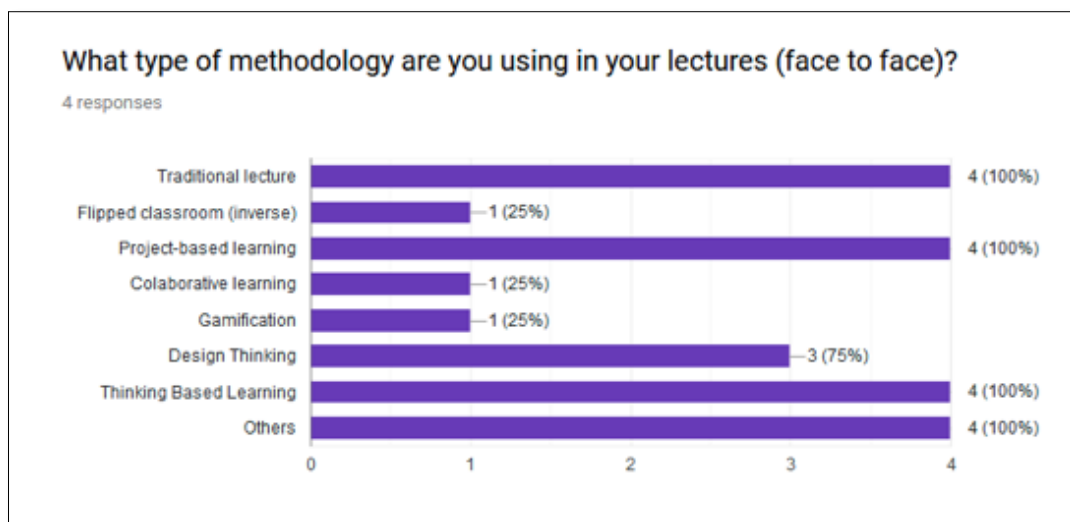


Figure 2: Types of methodology using in lectures.

Figure 2 shows Types of methodology using in lectures. Based on Figure 2, all institutions (100%) use traditional lecture, project-based learning and thinking based learning in their teaching methodologies. However, only 25% of them involved with flipped classroom, collaborative learning and gamification. At a moment, not all institutions have capabilities to facilitate and engage with new teaching methodologies. 75% of the institutions used design thinking method in teaching.

All the institutions also adapted others type of methodologies listed in Figure 3 such as case study, factory visits, online based learning, problems-based learning, skill-based learning and ICT.

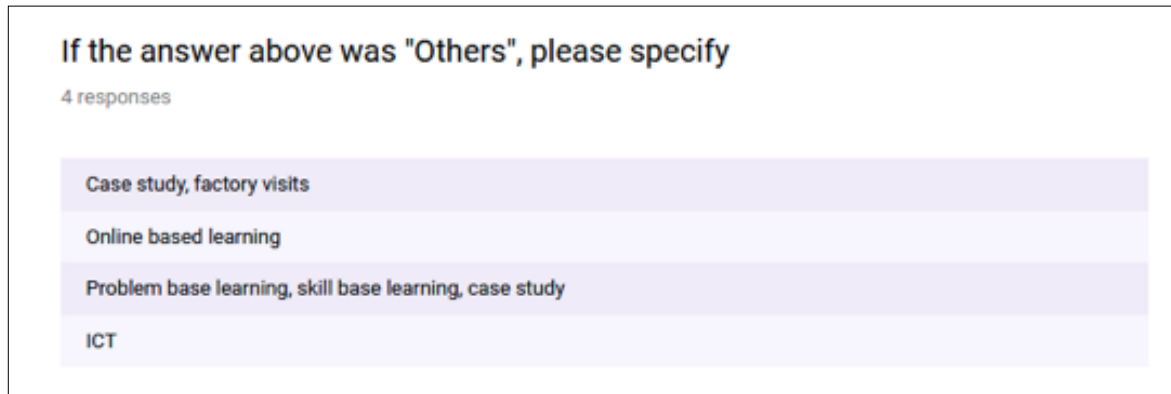


Figure 3: Other types of methodology in lectures.

Figure 4 indicated types of assessment methodology using in lectures. The 75% of the Malaysian universities use continuous assessment and 25% (one response) choose others. By referring figure 5, some the lists of response for others can be included as continuous assessment as well [3].

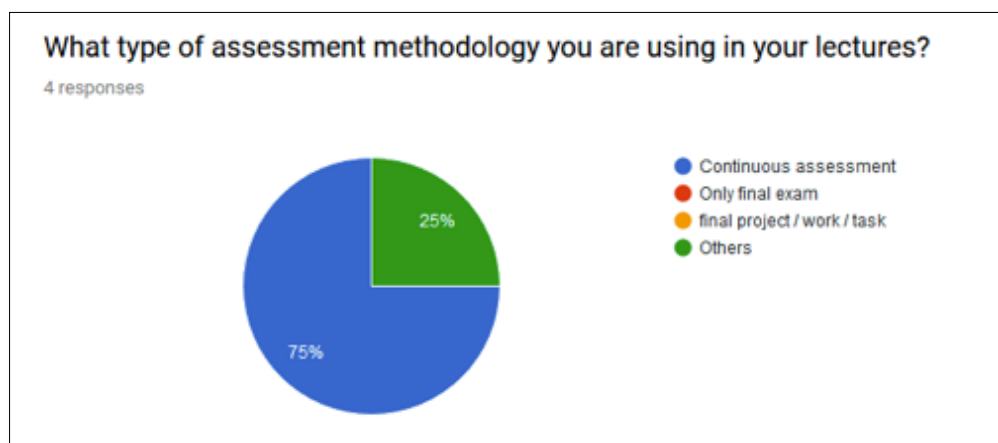


Figure 4: Types of assessment methodology.

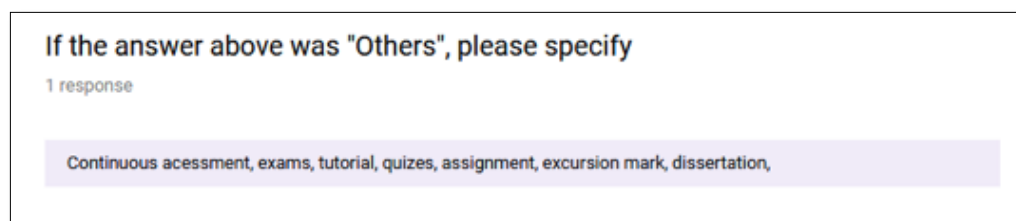


Figure 5: Other types of assessment methodology.



In order to comply with the methodology currently in use in the respondent universities and considering the resources of each university, the consortium has defined the following methodology:

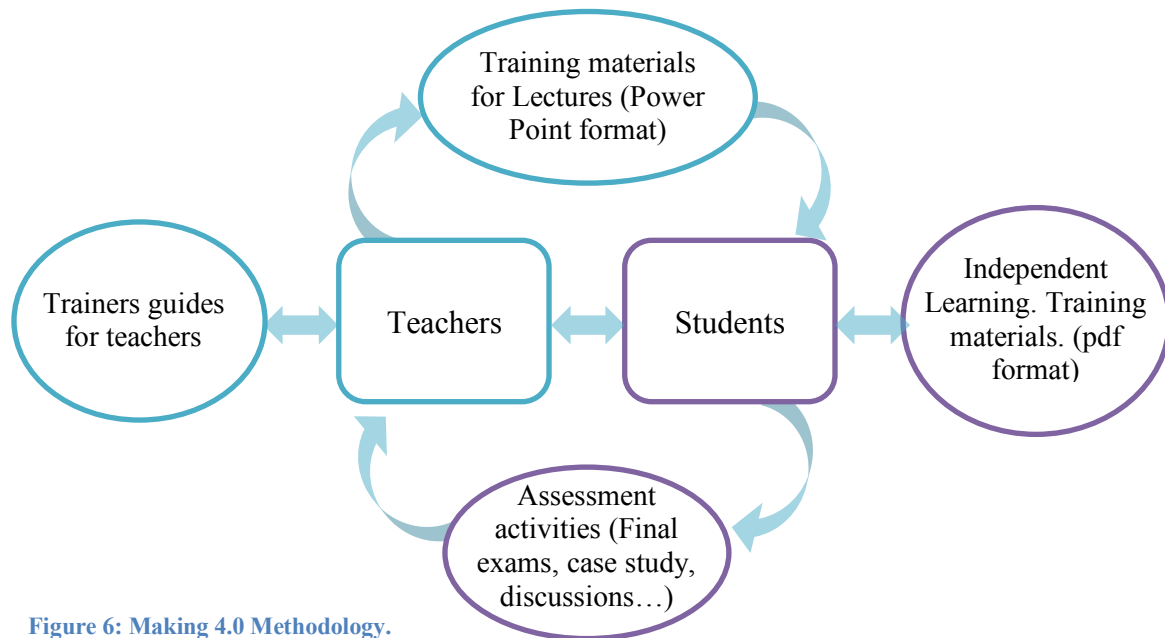


Figure 6: Making 4.0 Methodology.

### ⇒ Trainers guides.

Under WP3 **Task 3.3 “Development of trainers guides”**, a guide will be developed for each of the courses. These will be designed for instructors so that teachers in Malaysia will have a support tool to learn the basic concepts of each subject and the best methodological aspects to apply in class. The guides will include some exercises and examples that can be used by the teacher.

The training contents to be developed in the **task 3.1 “training content development”** of the WP3, are divided into two formats:

### ⇒ Training materials for Lectures.

Generally, and according to the results of the survey carried out, at Malaysian universities a semester is divided into 14 weeks. All the courses to be developed for the master's degree have a duration of two Malaysian credits (between 80 and 83 SLT each course).

As we have seen in table 1, the theoretical-practical courses are composed of 14 hours of lectures (one hour per week), and the theoretical courses of 28 hours of lectures (2 hours

per week). With these data, the consortium will develop in Power Point format the didactic contents that the teacher will use for each one of the hours of Lecture in the different courses.

⇒ **Training materials for independent learning.**

For the independent learning of the student, a "Course Book" will be developed for each of the courses in pdf format. As we have seen in table 1, for our master, the SLT dedicated to NF2F vary between 24 and 52 according to the type of course (theoretical or theoretical-practical).

In addition to this course book, we will develop the necessary contents to carry out the practical parts such as group discussions, case studies, modular projects...

⇒ **Assessment activities.**

From the results obtained through the Malaysian universities, we come to the conclusion that the evaluation methodology most commonly used in lectures is that of "continuous assessment". In addition, other types of assessment are used such as exams, tutorials, quizzes and assignment.

In most of the courses of the Master that we are developing, continuous assessment has a weight of 70% as opposed to the final which has 30%, and is aimed at evaluating cognitive domain by conducting a final exam. Those evaluation activities that best suit the definition of each course will be developed.

In addition to the above, to pass the master's degree the student will have to do an internship and a Master Thesis.

The Master Thesis will be defined in the Joint Curriculum and will be developed in depth in **T3.2 "Development of the final assessment activity"** of WP3.

All training materials will be developed to achieve the course learning outcomes defined in each of the courses, and both the PLOs assigned to each CLO and the soft skills will be evaluated to ensure that the student acquires all predefined knowledge and competencies. Providing this alignment will encourage students to adopt learning approaches that will result in the achievement of the CLOs and therefore help in the achievement of the PLOs. [2] Show figure 7.

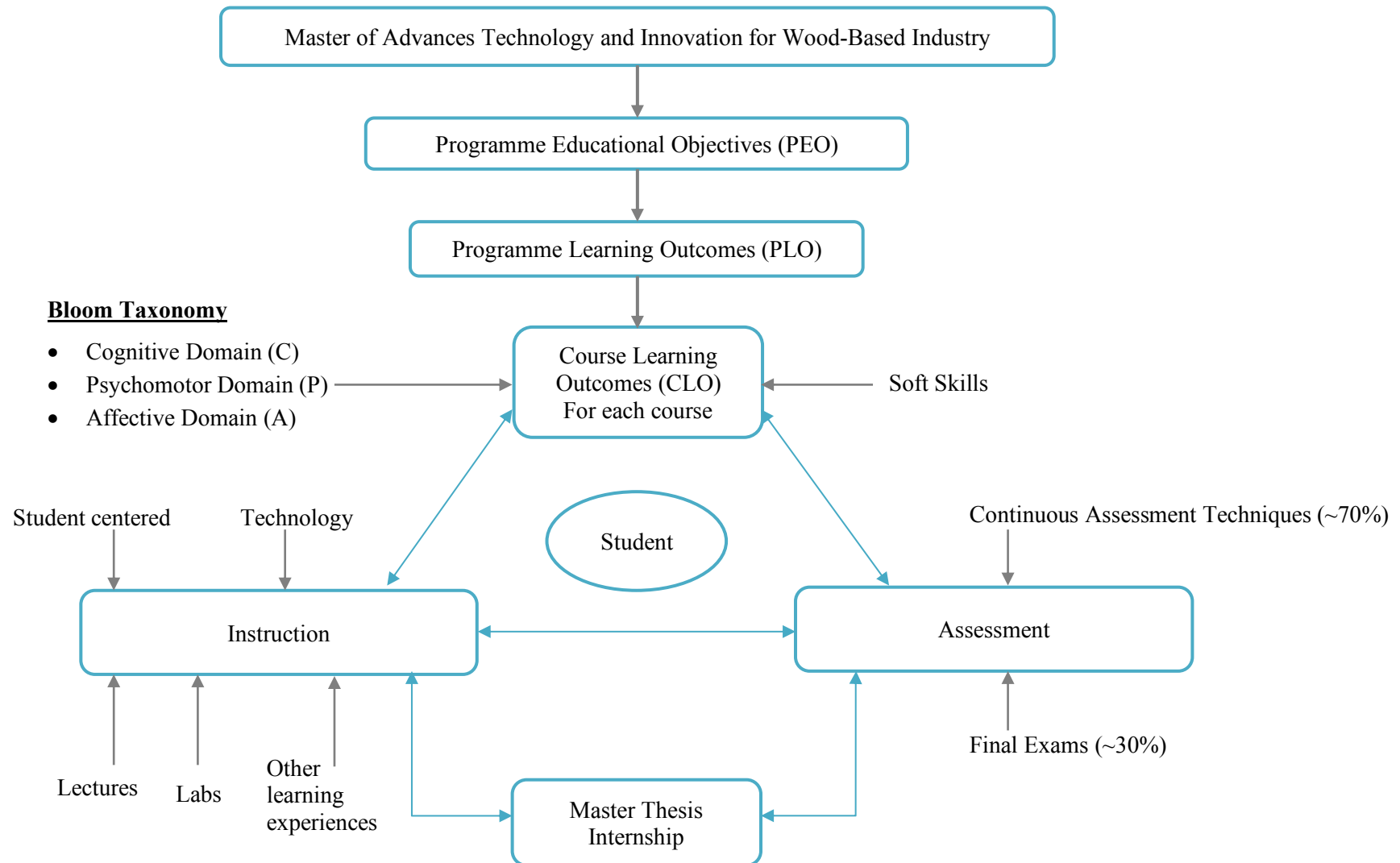


Figure 7: Relationship between assessment and learning and teaching activities in the achievement of results for the Making 4.0 master's degree. [2]

To reinforce the information in figure 7, the mapping of the PEOs with the PLOs is shown below (Table 5), in addition to its relationship with the bloom taxonomy and soft skills (Table 6), teaching and learning activities and evaluation activities (Table 7).

MAPPING PEOs WITH PLOs	No.	Program Educational Objective (PEO)  Master of Advanced Technology and Innovation for Wood-Based Industry	Program Learning Outcome (PLO)						
			demonstrate mastery of KETs knowledge in the wood and furniture industry	apply practical skills about digital transformation in the wood and furniture industry	relate ideas to societal issues in wood and furniture industry	conduct research with minimal supervision and adhere to legal, ethical and professional codes of practice	demonstrate leadership qualities through communicating and working effectively with peers and stakeholders	generate solutions to problems in wood and furniture industry using scientific and critical thinking skills	manage information for lifelong learning
			C	P	A	A	A	C	A
			PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
	1.	knowledgeable in the field of Key Enabling Technologies (KET) of the Industry 4.0 and current trends of wood materials and processes with appropriate skills and attitude to work in wood-based industry.	√	√					√
	2.	capable to apply the Key Enabling Technologies (KET) and the sustainable innovation within the production processes of the wood based industry.		√				√	√
	3.	Innovative and creative, as well as aware and committed with a more sustainable and technological productive society.			√	√	√		

Table 5: Mapping PEOs with PLOs.

BLOOM TAXONOMY	LEVEL OF BLOOM TAXONOMY DOMAIN	PROGRAM LEARNING OUTCOME (PLO)	SOFT SKILL*	MQF DOMAIN OF LEARNING OUTCOME	INTENDED PLO STATEMENT FOR MASTER PROGRAM
COGNITIVE	C1 – C6	PLO1	-	Knowledge of Discipline Area	<i>demonstrate mastery of knowledge of KETs in the wood and furniture industry</i>
(C)	C1 – C6	PLO6	CTPS	Problem Solving and Scientific Skills	<i>generate solutions to problems using scientific and critical thinking skills</i>
PSYCHOMOTOR (P)	P1 – P7	PLO2	-	Practical Skills	<i>apply practical skills about digital transformation in the wood and furniture industry</i>
AFFECTIVE	A1 – A5	PLO3	TS	Social Skills and Responsibilities	<i>relate ideas to societal issues in wood production processes</i>
(A)	A1 – A5	PLO4	EM	Values, Attitudes and Professionalism	<i>conduct research with minimal supervision and adhere to legal, ethical and professional codes of practice</i>
	A1 – A5	PLO5	CS, LS	Communication, Leadership and Team Skills	<i>demonstrate leadership qualities through communicating and working effectively with peers and stakeholders</i>
	A1 – A5	PLO7	LL	Information Management and Lifelong Learning Skills	<i>manage information for lifelong learning</i>
<div> <div> <p>*Soft skills abbreviation: CTPS : critical thinking and problem solving TS : social skills EM : Ethics, morale, values, and professionalism CS : communication skills LS : leadership skills</p> </div> <div> <p><b>Level of Cognitive (C) domain:</b></p> <p>C6 – Creating C5 – Evaluating C4 – Analyzing C3 – Applying C2 – Understanding C1 – Remembering</p> </div> <div> <p><b>Level of Psychomotor (P) domain:</b></p> <p>P7 – Origination P6 – Adaptation P5 – Complex overt response P4 – Mechanism P3 – Guided response P2 – Set P1 – Perception</p> </div> <div> <p><b>Level of Affective (A) domain:</b></p> <p>A5 – Internalizing Values A4 – Organization A3 – Valuing A2 – Responding A1 – Receiving</p> </div> </div>					

Table 6: Mapping between MQF domain of learning outcome, bloom taxonomy and soft skills.

BLOOM TAXONOMY	LEVEL OF BLOOM TAXONOMY DOMAIN	PROGRAM LEARNING OUTCOME (PLO)	SOFT SKILL*	MQF DOMAIN OF LEARNING OUTCOME	Teaching and Learning Activities	Assessment Activities
<b>COGNITIVE</b>	C1 – C6	<b>PLO1</b>	-	Knowledge of Discipline Area	Lecture, Tutorial, Self-directed Learning, SCL type like PBL, POPBL, etc.	Oral or written examination, viva, report, log book, project paper etc.
<b>(C)</b>	C1 – C6	<b>PLO6</b>	CTPS	Problem Solving and Scientific Skills	Lecture, practical, tutorial, self-directed learning, experiential learning, SCL type like PBL, POPBL, etc.	Exam, assignment, project report, case study, role-play, final year project, etc.
<b>PSYCHOMOTOR (P)</b>	P1 – P7	<b>PLO2</b>	-	Practical Skills	Practical work, laboratory experiment, demonstrations, etc.	Observation through practical work (rubric)
<b>AFFECTIVE</b>	A1 – A5	<b>PLO3</b>	TS	Social Skills and Responsibilities	SCL activities like group discussion, role play, case study, PBL, POPBL, field work, etc	Observation rubric, peer assessment, etc.
<b>(A)</b>	A1 – A5	<b>PLO4</b>	EM	Values, Attitudes and Professionalism	SCL activities like group discussion, role play, case study, PBL, POPBL, field work, etc	Observation rubric, supervisory report, peer assessment, etc.
	A1 – A5	<b>PLO5</b>	CS, LS	Communication, Leadership and Team Skills	SCL activities like group discussion, role play, case study, PBL, POPBL, field work, etc	Observation rubric, assignment, essay, case study report, presentation, scenario-based debate, etc.
	A1 – A5	<b>PLO7</b>	LL	Information Management and Lifelong Learning Skills	SCL activities like group discussion, case study, PBL, POPBL, etc	Literature review, assignment, case study report, final year project, etc.

Table 7: Constructive alignment between learning outcomes, teaching and learning activities, and assessment activities.

### 3. References

- [1] Garis Panduan Pembangunan Program Akademik Universiti Awam Edisi Kedua. Available online at: [https://umexpert.um.edu.my/file/publication/00003125\\_166658\\_78749.pdf](https://umexpert.um.edu.my/file/publication/00003125_166658_78749.pdf)
- [2] Guidelines to good practices: assessment of students (2014). Malaysian Qualifications Agency 2014.
- [3] Continuous assessment. Url: (<http://stll.au.dk/en/resources/assessment-methods/continuous-assessment/>)





## Annex 1: T2.3 Results of the survey about the Malaysian Teaching Methodology.

### Result.

Figure 1 shows hours of theory lessons (face to face lecture) comprised in one credit at each institution. Based on Figure 1, two institutions out of four institutions having similar 14 hours of theory lesson (face to face) which were comprised in one credit. One institution has 12 hours (face to face) for one credit. Another response showed 1 hour for 1 credit unit, perhaps it was referring as one-hour face to face lecture per week. Generally, Malaysian public university has 14 weeks of study in 1 semester [1].

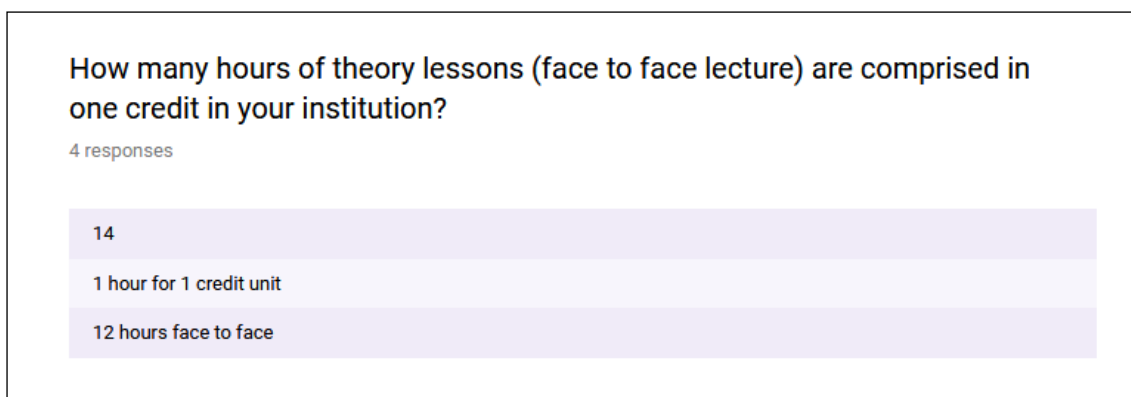


Figure 1. Hours of theory lessons (face to face) in one credit.

In the case of 14 weeks of study in 1 semester. By considering 1 hour per week for 1 credit, all four institutions are having almost same hours of theory lessons (face to face) for one credit within the range of 12 to 14 hours.

Figure 2 illustrates hours of practice lesson (laboratory) in one credit. There is no clear trend that could be seen from this figure. The result for this questionnaire was a mix.

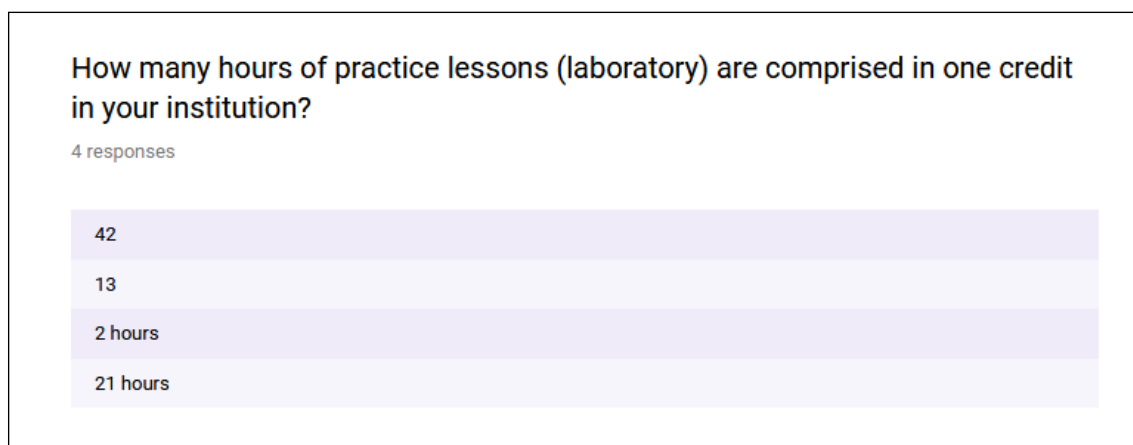


Figure 2. Hours of practice lesson (laboratory) in one credit.



By looking deep into each response, the result can be analysed case by case as follows:

**Case 1: 42**

Assume that the practice lesson is 3 hours per week for 14 weeks (2 credits).

$3 \text{ hours} \times 14 \text{ weeks} = 42 \text{ hours}$ .

If 42 hours for 2 credits, therefore 21 hours for 1 credit.

**Case 2: 13**

Assume that the practice lesson is 2 hours per week for 13 weeks (2 credits).

$2 \text{ hours} \times 13 \text{ weeks} = 26 \text{ hours}$ .

If 26 hours for 2 credits, therefore 13 hours for 1 credit.

**Case 3: 2 hours**

Assume that 2 hours means the practice lesson is 2 hours per week for 14 weeks (2 credits).

$2 \text{ hours} \times 14 \text{ weeks} = 28 \text{ hours}$ .

If 28 hours for 2 credits, only 14 hours for 1 credit.

**Case 4: 21 hours**

This could be similar as Case 1.

Overall, the hours of practice lesson (laboratory) for all partners' institutions can be said within 13 to 21 hours for 1 credit. Depending on the universities, the hours offered for laboratory, are either 2 or 3 hours per week.

Figure 3 illustrates hours of student home work in one credit. There is no clear trend at all among all partners institutions result for this questionnaire.

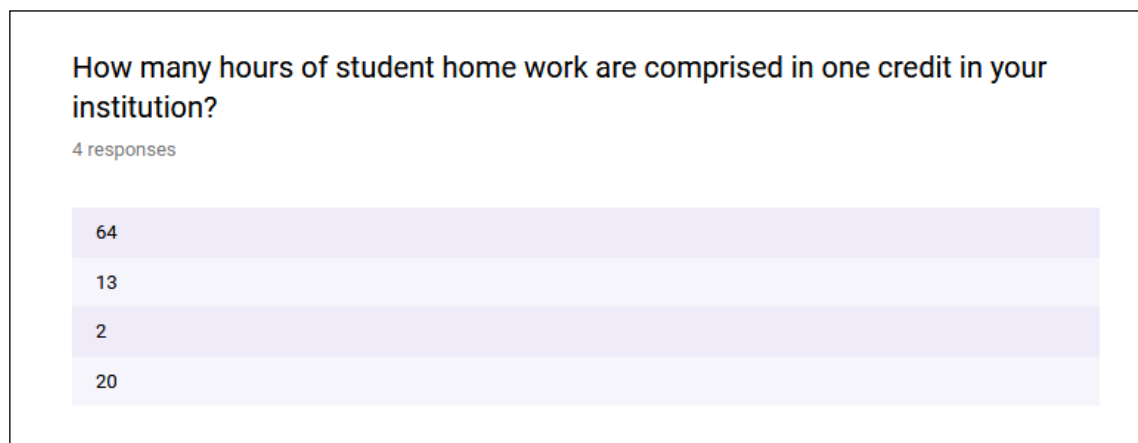


Figure 3. Hours of student home work in one credit.

Same as previous situation, this result can be analysed case by case with some general assumptions:

1. Student home work is equal to independent learning time (non face to face) which is one of the Student Learning Time (SLT) components.
2. Ratio face to face lecture to independent learning time is 1:1-2 [1]

Case 5: 64

Assume that the face to face lecture is 4 hours per week for 14 weeks (4 credits).  
 $4 \text{ hours} \times 14 \text{ weeks} = 56 \text{ hours}$ . \*The differences value between response (64) and calculated (56) is 8 hours. Perhaps 8 hours is considered as another component of SLT such as preparation time for assignment\*.

With ratio 1:2, the independent learning time =  $2 \times 56 \text{ hours} = 112 \text{ hours}$ .

Thus, independent learning time for one credit =  $112/4 = 28 \text{ hours}$

Therefore, hours of student home work in one credit is 28 hours.

Case 6: 13

Assume that the face to face lecture is 4 hours per week for 13 weeks (4 credits).

$4 \text{ hours} \times 13 \text{ weeks} = 52 \text{ hours}$ .

With ratio 1:1, the independent learning time =  $1 \times 52 \text{ hours} = 52 \text{ hours}$ .

Thus, independent learning time for one credit =  $52/4 = 13 \text{ hours}$

Therefore, hours of student home work in one credit is 13 hours.

Case 7: 2

Perhaps number 2 is representing the ratio of face to face lecture to independent learning time is 1 to 2.

Assume that the face to face lecture is 4 hours per week for 14 weeks (4 credits).

$4 \text{ hours} \times 14 \text{ weeks} = 56 \text{ hours}$ .

With ratio 1:2, the independent learning time =  $2 \times 56 \text{ hours} = 112 \text{ hours}$ .

Thus, independent learning time for one credit =  $112/4 = 28 \text{ hours}$

Therefore, hours of student home work in one credit is 28 hours.

Case 8: 20

Assume that the face to face lecture is 4 hours per week for 13 weeks (4 credits).

$4 \text{ hours} \times 13 \text{ weeks} = 52 \text{ hours}$ .

With ratio 1:1.5, the independent learning time =  $1.5 \times 56 \text{ hours} = 78 \text{ hours}$ .

Thus, independent learning time for one credit =  $78/4 = 19.5 \text{ hours}$

Therefore, hours of student home work in one credit is close to 20 hours.

Overall, the hours of student home work in one credit for all partners' institutions can be said within the range of 13 to 28. Depending on the universities, the ratio of face to face lecture to independent learning time is 1:1-2 [1].

Figure 4 shows Types of methodology using in lectures. Based on Figure 4, all institutions (100%) use traditional lecture, project-based learning and thinking based learning in their teaching methodologies. However, only 25% of them involved with flipped classroom, collaborative learning and gamification. At a moment, not all institutions have capabilities to facilitate and engage with new teaching methodologies. 75% of the institutions used design thinking method in teaching.

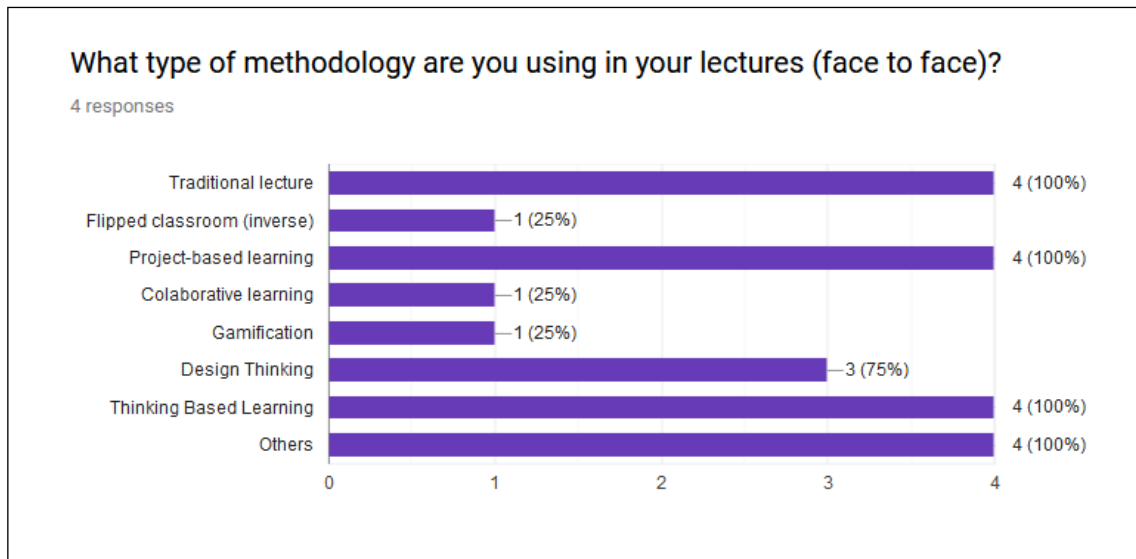


Figure 4. Types of methodology using in lectures.

All the institutions also adapted others type of methodologies listed in Figure 5 such as case study, factory visits, online based learning, problems-based learning, skill based learning and ICT.

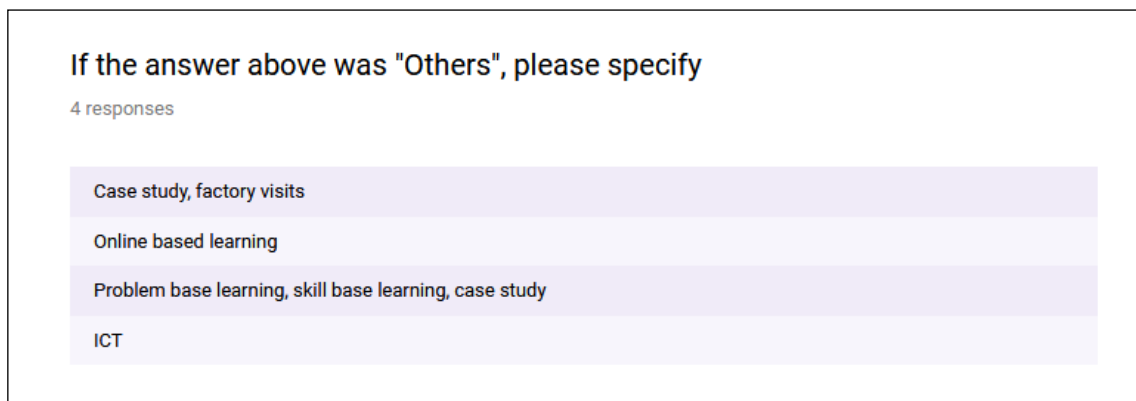


Figure 5. Other types of methodology in lectures

Figure 6 shows Types of resource using in lectures. All institutions (100%) used same resources in lectures such as slides, textbook, lectures using blackboard, case studies, and practice lessons in laboratories. Except 1 out of 4 (25%) institution do not use exercise using blackboard. In addition, all institutions also used others resources as listed in Figure 7.

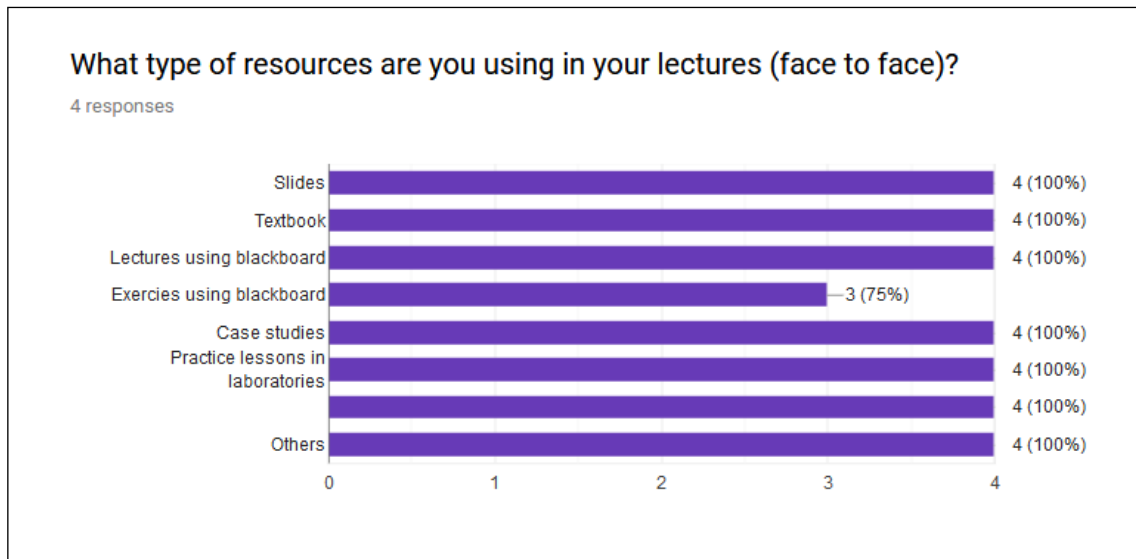


Figure 6. Types of resource using in lectures.

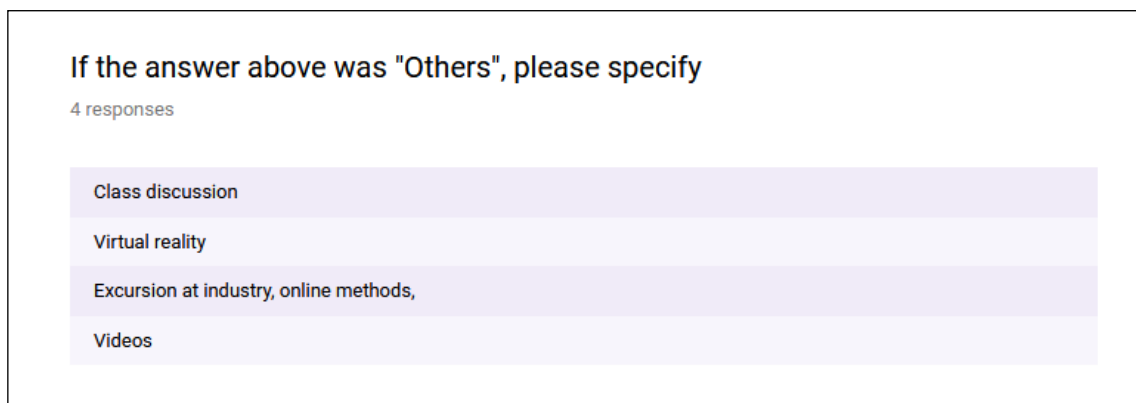


Figure 7. Other types of resource using in lectures

Figure 8 indicated types of assessment methodology using in lectures. Based on Figure 8, 75% of the Malaysian universities use continuous assessment and 25% (one response) choose others. By referring Figure 9, some the lists of response for others can be included as continuous assessment as well [3].

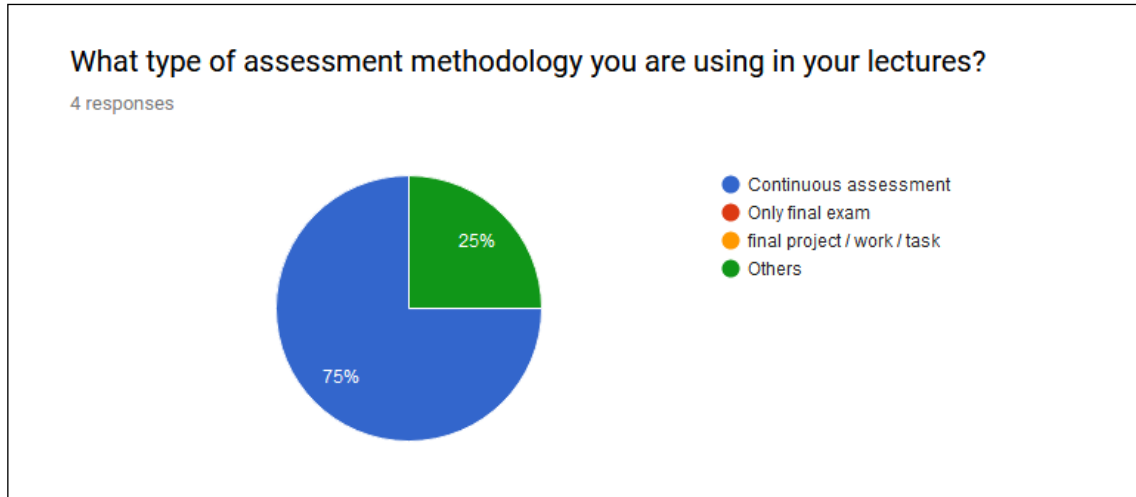


Figure 8. Types of assessment methodology in lectures

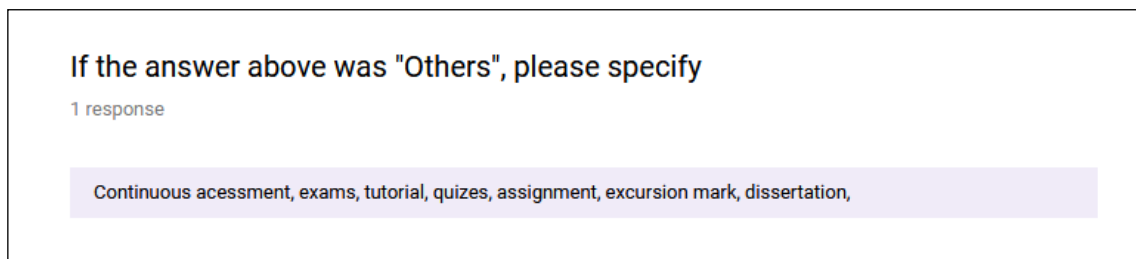


Figure 9. Others types of assessment methodology in lectures

## Annex 2. Survey form.

# Survey about the Malaysian Teaching Methodology

Please, answer this questionnaire. Only one answer per institution.

How many hours of theory lessons (face to face lecture) are comprised in one credit in your institution? \*

Long-answer text

How many hours of practice lessons (laboratory) are comprised in one credit in your institution?

Long-answer text

How many hours of practice lessons (laboratory) are comprised in one credit in your institution?

Long-answer text

What type of methodology are you using in your lectures (face to face)?

- ☐ Traditional lecture
- ☐ Flipped classroom (inverse)
- ☐ Project-based learning
- ☐ Colaborative learning
- ☐ Gamification
- ☐ Design Thinking
- ☐ Thinking Based Learning
- ☐ Others

If the answer above was "Others", please specify

Short-answer text

What type of resources are you using in your lectures (face to face)? \*

- ☐ Slides
- ☐ Textbook
- ☐ Lectures using blackboard
- ☐ Exercises using blackboard
- ☐ Case studies
- ☐ Practice lessons in laboratories
- ☐ Exercises in groups (theory or practice)
- ☐ Others

If the answer above was "Others", please specify

Short-answer text

What type of assessment methodology you are using in your lectures?

- ☐ Continuous assessment
- ☐ Only final exam
- ☐ final project / work / task
- ☐ Others

If the answer above was "Others", please specify

Short-answer text