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Master Degree in Industry 4.0

Ind4.0 (610455-EPP-1-MY-EPPKA2-CBHE-JP

DELIVERABLE OF ERASMUS+IND4.0 WP2
D2.3 Study Visits to Europe for Curriculum Development

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Abstract:	This deliverable describes the results of the two virtual study Visits to EU HEIs that were conducted with the aim to transfer knowledge and expertise from EU partners to Asian partners on curriculum development. Details of the activities undertaken and the results of the visits are described.

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Abstract

This report describes the actions undertaken and the results of the 2 virtual study visits that took place in March and April 2021. The main objective of the study visit was to transfer knowledge from the European partners to Asian partners and to design the 1st version of the MSc in Industry 4.0 curriculum.

The document is organized in two sections:

Part 1: describes the 1st virtual study visit hosted by HOU.

Part 2: describes the 2nd virtual study visit hosted by USGM/La Sapienza.

Supporting material used during the visits is presented in the Annexes.

1 First Study Visit

1.1 Basic information

The 1st study visit took place between 22/3/2021 - 24/3/2021. It was a virtual meeting instead of an actual study visit due to COVID19 restrictions. All partners participated with at least 5 representatives. The main virtual session had an attendance of more than 50 representatives for the three days of the virtual visit. Some screenshots from the study visit are presented in Annex IV.

1.2 Programme

Due to the severe limitations posed by the time difference and the fact that the meeting was virtual, partners used online tools for facilitating discussions and reaching decisions. Material necessary for reaching decisions was available beforehand.

The programme of the 1st study visit is presented in Annex I.

1.3 Aims and methodology

The aim of the visit was to exchange knowledge and good practices from running Industry 4.0 related post-graduate courses in EU HEIs and decide on core aspects of the Industry 4.0 curriculum.

Specific goals included:

- Presentation of educational models for teaching MSc courses and presentation of existing curricula
- Design of the structure of the curriculum
- Discussion over various actors affecting the delivery of the MSc course
- Design of the high level description of the courses

Knowledge transfer was accomplished by both describing similar curriculum but emphasising on teaching methodologies as well. The content used to this end, is presented in Annex II.

Using a poll, the partners voted for the courses that should be included in the MSc curriculum. The vote took place before the meeting and the results were presented during the meeting. The results of the poll are presented in Annex III.

As a first step, the final structure of the curriculum was decided; the profile of the students and the educational goals was set. Partners considered the various parameters that affect the delivery of the course in the institutions (legal, academic, educational, regulatory etc. factors).

In the second step, the partners were organized in 4 Working Groups (WG) according to their specialties and interests. Each WG was responsible for drafting the high level description of a specific set of courses. The number of WG was decided during the meeting.

1.4 Presentation of existing practices

Presentation about existing practices in teaching MSc courses using the distance learning model facilitated the transfer of knowledge from EU HEIs to Asian partners.

A distinctive presentation is included in Annex II.

1.5 Poll results

Prior to the meeting, a poll took place so as to record the opinions of the partners concerning the structure of the programme. In summary, the main results indicated that there is a need for different configurations in the structure of the programme due to different organizational and national rules.

The results of the poll are presented in Annex III.

1.6 Student Profile

Following a fruitful discussion, the consortium decided that: the MSc programme accepts candidates who have a Bachelor's degree in Engineering, Natural Sciences (Agriculture, Biology, Chemistry), Theoretical Sciences (Mathematics, Physics) or Information and Communication Technologies (Computer Science, Inf. Systems) or equivalent disciplines.

Candidates may need to complete a computer programming course.

1.7 The curriculum structure

After taking into account the poll results, an initial version of the structure and the courses proposed by HOU and communicated to the partners prior to the meeting, and following a fruitful discussion between all HEIs, the consortium reached a final decision for:

1. The structure of the MSc Programme
2. The titles of the courses to be included in the Programme
3. The description of the courses to be included in the Programme

1.7.1 Duration

For a full time student, the minimum duration is:

- 18 months (Malaysia) – 3 semesters
- 24 months (Indonesia) – 4 semesters
- 18 months (Cambodia) – 4 semesters (each semester has a duration of 3-4 months)

1.7.2 Structure

The structure of the curriculum will be designed by individual HEIs according to national regulations and institutional capacity. The courses will be chosen from a list of 23 proposed courses of four different types:

- Core courses: 7 courses
- Compulsory courses: 3 courses
- Elective courses: 4 courses
- Orientation courses: 9 courses

Three VET courses were also identified.

Credits awarded to different course categories are adjusted by each HEI according to their national accreditation system.

Each HEI will be responsible for the organisation of courses into semesters according to institutional regulations and capacity.

1.7.3 Theses/Placement

There are different configurations for the target countries:

- Malaysia: Theses (100% score) or Placement +Dissertation (30% of the credit +70% of the credit),
- Indonesia: Theses (100% credit– obligatory), no Placement possible,
- Cambodia: Theses (100% credit) or Report and National Exams (100% credit).

1.7.4 List of courses

The list of courses per type is presented in the following tables:

Code	Course Title	Course Type	Application Area
CO1	Cyber security in Industry 4.0	Core	All
CO2	Networking Technologies and Sensors	Core	All
CO3	Artificial Intelligence (1st semester)	Core	All
CO4	Big Data Analytics (2nd semester)	Core	All
CO5	Cloud Computing Services and Technologies	Core	All
CO6	Robotics and Industry 4.0	Core	All
CO7	Ind. 4.0 cyber-physical systems Engineering	Core	All

Table 1: Core Courses

Code	Course Title	Course Type	Application Area
COM1	Research Methodology (1st or 2nd sem.)	Comp	All
COM2A	Research Theses	Comp	All
COM2B	Placement/Dissertation	Comp	All

Table 2: Compulsory Courses

Code	Course Title	Course Type	Application Area
EL1	Digital Transformation and Business Models	EL	All
EL2	Entrepreneurship, funding and Innovation	EL	All
EL3	HCI for Industry 4.0	EL	All
EL4	Optimization of Intelligent Systems	EL	All

Table 3: Elective Courses

Code	Course Title	Course Type	Application Area
OM1	Sustainable Product Design & Manufacturing	O	Manufacturing
OM2	Prototyping in Manufacturing 4.0	O	Manufacturing
OM3	Process management in Manufacturing 4.0	O	Manufacturing
A1	Agriculture/ Aquaculture system design	O	Agri/Aquac. 4.0
A2	Autonomous robots	O	Agri/Aquac. 4.0
A3	Ecosystems for optimised/precision farming/aquafarming	O	Agri/Aquac. 4.0
H1	Medical Imaging and Digital Image Processing fundamentals	O	Health 4.0 /Pervasive Health
H2	Machine learning and big data analytics in Healthcare	O	Health 4.0
H3	Mobile and Pervasive Health Technologies	O	Health 4.0

Table 4: Orientation Courses

VET Courses		
Code	**Course Title**	**Durations (in hours)**
INDVET1	Introduction to Manufacturing 4.0	4
INDVET2	Introduction to Agriculture/Aquaculture 4.0	4
INDVET3	Introduction to Pervasive Health/ Health 4.0	4

Table 5: VET Courses

1.7.5 Course descriptions

Using a template for course description, partners were organized in 4 working groups (each one facilitated by an EU HEI) and worked in parallel to produce a short description of each course (1 paragraph), along with a list of educational goals.

The template will be used as input to a second phase where the detailed description of the courses will take place. The results of this work are detailed in Deliverable 2.6 Ind4.0 MSc Course Catalogue-Profile.

ANNEX I – Programme of the 1st Study Visit

Study Visit Programme

Day 1 – 22/3/2021		
Time	**Topic**	**Responsible Partner**
09:00-09:30	Welcome	HOU
09:30-10:00	The Embedded Systems MSc course at HOU.	HOU
10:00–10:30	The HOU Learning model: teaching postgraduate courses from a distance.	HOU
10:30-11:00	Introduction to the aim and goals of the virtual visit. Status of the project.	HOU, UiTM
11:00-11:10	Break	
11:10-12:30	Poll results and WP1 Findings: what are the key findings and proposed directions.	HOU

Day 2 – 23/3/2021		
Time	**Topic**	**Responsible Partner**
09:00-11:00	The profile of the Ind. 4.0 students (expectations, motivation, goals, prohibitors, country and institutional considerations).	HOU, UiTM, All
11:00-11:10	Break	
11:10-12:10	Design of the overall structure of the curriculum (number of courses, semesters, course topics, complementarity of courses, institutional capacity to deliver of courses etc.).	HOU, UiTM, All
12:10-12:30	Organisation in Working Groups	HOU, UiTM

Day 3 – 24/3/2021		
Time	**Topic**	**Responsible Partner**
09:00–11:00	**Parallel Working Groups** High level design of the content of the courses (educational goals, duration, laboratories, content, teaching and assessment methods, textbooks)- Part 1.	HOU, UiTM, All
11:00-11:10	Break	
11:10-12:30	**Parallel Working Groups** High level design of the content of the courses (educational goals, duration, laboratories, content, teaching and assessment methods, textbooks)- Part 2.	HOU, UiTM, All

ANNEX II – Existing practices at HOU

MSc course in Industry 4.0

The HOU Learning model: teaching postgraduate courses from a distance

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Co-funded by the Erasmus+ Programme of the European Union

Contents

Hellenic Open University - Overview

- HOU is a state University (est. 1992, op. 1997)
- Ranked 4th in Europe
- Open and Distance Learning model
- BSc and MSc Programmes
- Supervised by the Ministry of Education
- Small number of permanent academic staff
- Large number of academic staff from other HEIs or Phd holders.
- Yearly assessment since 2001.

Hellenic Open University – in numbers

- >40.000 students
- Undergraduates: 19.054
- Post-graduates: 18.509
- Doctoral: >100
- Academic staff: 1.995
- Administrate staff: 202
- No of graduate programmes: 8
- No of postgraduate programmes: 47
- Short courses: 11

Hellenic Open University – Business model

- State education is free
- …but HOU students pay a fee
- This fee is directed to:
  - Operational costs
  - Tutor fees
  - Books
  - Renting of space for teaching f2f
- HOU also receives some government funding
- Self sustained model

Hellenic Open University – Avg Student Profile

- Age 30 (18 -70)
- Employed
- With family
- With BSc (for MSc programmes)
- Needs an avg. of 4 years for BSc
- Needs an avg. of 2 years for a MSc
- Workload on weekends
- Geography: national wide
- Sex: depends on programme
- Goals (for MSc): use degree for better job positioning

Contents

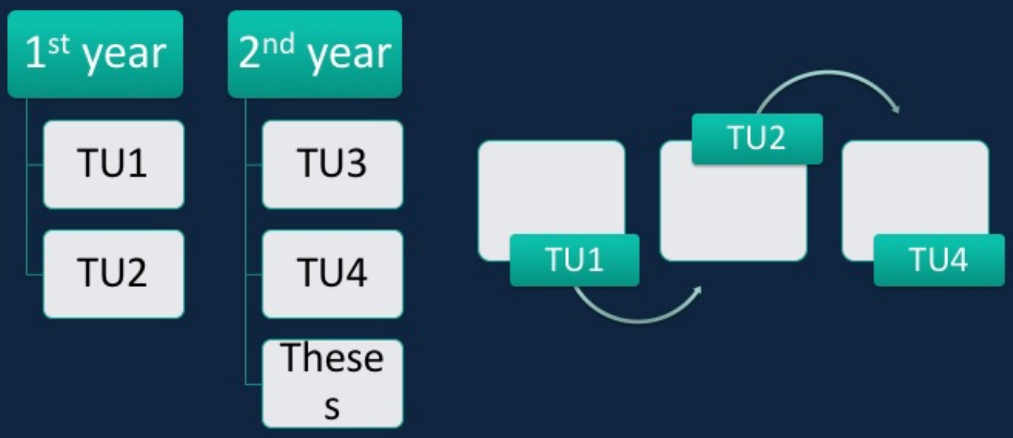
Learning model - overview

Learning model Overview– Organisation

An MSc programme is organised in:

- 120 ECTS
- Min 2 academic years (1/10-31/7)
- No semesters within an academic year (unique in Greek HEIs)
- The curriculum is organised in Thematic Units (TU) – 5-6 in total
- Each TU includes 3 subjects (textbooks)
- Load: 2 TU/per year + Theses in the 2nd year
- Curriculum includes obligatory and selective TUs
- Theses is obligatory
- Specialization paths may exist

Learning model Overview– Organisation – Load/Paths



Learning model Overview– Teaching Unit

Duration: 1 academic year

- Teaching (1/10-31/5)
- Final Exams (1/6-30/6)
- 2nd round Exams (1/7-31/7) - only for students who failed or did not take part in the final exams

Educational Load:

- 3 subjects roughly equivalent to 3 University courses
- Subject are taught in a sequence (one after the other)
- Each subject is supported by 1 textbook and additional content
- Each subject is evaluated through:
  - at least 1 assignment
  - 33% of the topics in exams

Learning model Overview– TU- Student groups

In each Teaching Unit:

- Students are organized in Teaching Groups (TGs) (7-30)
- 1 group is assigned to 1 tutor (max 1:30 ratio)
- 1 TU is comprised of 1-32 students
- All TG within a TU adhere to a common teaching timetable

- Each Teaching Group
  - Has its own online forum
  - Assignments are graded by the corresponding tutor
  - Personalized feedback / learning support

Learning model Overview– TU- Timetable

Teaching Unit Timetable:

- Load distribution per week for the whole duration of the unit

ΧΡΟΝΟΔΙΑΓΡΑΜΜΑ ΜΕΛΕΤΗΣ ΚΑΙ ΓΡΑΠΤΩΝ ΕΡΓΑΣΙΩΝ
Θ.Ε. ΠΛΗΜ2
ΑΚΑΔΗΜΑΪΚΟΥ ΕΤΟΥΣ 2021-2022

Α/Α ΕΒΔΟΜΑΔΩΝ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΕΛΕΤΗΣ (ΑΠΟ)	ΗΜΕΡΟΜΗΝΙΕΣ ΜΕΛΕΤΗΣ (ΕΩΣ)	ΚΕΦΑΛΑΙΑ	ΠΑΛΤΤΕΣ ΕΡΓΑΣΙΕΣ	Ο.Σ.Σ.
1	04/10/21	10/10/21	Τόμος Γ, κεφ. 1 και ΕΔΥ «Τεχνικές Διαχείρισης Λογισμικού»	Ανακοίνωση	ΟΧΙ
2	11/10/21	17/10/21	Τόμος Γ, κεφ. 1 και ΕΔΥ «Τεχνικές Διαχείρισης Λογισμικού»		Στη ΟΣΣ
3	18/10/21	24/10/21	Τόμος Γ, κεφ. 2 και ΕΔΥ «Τεχνικές Διαχείρισης Κινδύνου»		
4	25/10/21	31/10/21	Τόμος Γ, κεφ. 2 και ΕΔΥ «Τεχνικές Διαχείρισης Ανθρώπινου Δυναμικού»		
5	01/11/21	07/11/21	ΕΔΥ «Έργο και Οικονομική Ανάλυση»		
6	08/11/21	14/11/21	ΕΔΥ «Έργο και Οικονομική Ανάλυση» και Τόμος Β, κεφ. 1		
7	15/11/21	21/11/21	Τόμος Β, κεφ. 2 και 3		
8	22/11/21	28/11/21	Τόμος Β, κεφ. 4.1-4.4 και ΕΔΥ «Έλεγχος Λογισμικού»	Παραδόσεις 1ης ΤΕ και ανακοίνωση 2ης ΤΕ	
9	29/11/21	05/12/21	Τόμος Β, κεφ. 4.5-4.6 και ΕΔΥ «Έλεγχος Λογισμικού»		
10	06/12/21	12/12/21	ΕΔΥ «Έλεγχος Λογισμικού»		Στη ΟΣΣ
11	13/12/21	19/12/21	Τόμος Β, κεφ. 5		
12	20/12/21	26/12/21	ΔΙΑΚΟΠΕΣ ΧΡΙΣΤΟΥΓΕΝΝΩΝ		
13	27/12/21	02/01/22	Τόμος Β, κεφ. 5 και 6		ΟΧΙ
14	03/01/22	09/01/22	Τόμος Β, κεφ. 6 και Επανάληψη ύλης		
15	10/01/22	16/01/22	Τόμος Α, κεφ. 1 και ανάγνωση του κεφ. 2		

Content to cover

Meeting

Assignment delivery

Week

Learning model Overview– Re-appearing…the disappearing tutor

The 'disappearing tutor' in distance learning is a major concern that affects:

- how students learn,
- how the educational material should be designed,
- how the bond between tutor-learner, learner-learner works,
- how assessment takes place.

- Some solutions offered by the learning model
  - 5 face to face meetings for each TU (4 h duration)
  - Face to face final exams (went online during COVID19)
  - Training of tutors in distance learning methodology
  - Educational material includes several elements of the learning process

Learning model Overview– Educational content – Textbooks

- Text books (published by HOU exclusively)
- Shipped to students before the beginning of the academic year
- Self-learning and self-assessment facilitation:
  - Detailed examples for theoretical topics
  - Frequent self assessment questions
  - Frequent self assessment activities
  - Detailed answers to self assessment (with instructions and encouragement)
  - Further reading material
  - Length according to weekly workload

Learning model Overview– Educational content –an example (1/5)

- Educational material is certified before approved for distribution (ISO25000 series)
- A certification guideline: 'the need for feedback provision to the learner'

Guideline description
The self-assessment exercises and activities are the primary means of instruction in distance education. They should be designed very carefully in order to provide appropriate feedback due to the lack of physical contact between learner - instructor.
Goal: The main task of the evaluator is to asses the quality of feedback in the educational content.
What is needed: Each exercise (especially any self-assessment activity) should contain feedback, indicating where the learner should focus and why. There should be a way out of possible educational bottlenecks (e.g. through tips, further reading etc.).

Learning model Overview– Educational content –an example (2/5)

- A certification guideline: 'the need for feedback provision to the learner'

Guideline implementation method

Check the answers of each self-evaluation exercise and any other activity for:

- a clear statement of the educational goals of the exercise,
- analytical solution (in the self-assessment exercises),
- model of a solution or key points for solving (for activities only),
- reference to the level of difficulty,
- instructions for getting over possible educational bottlenecks.

Learning model Overview– Educational content –an example (3/5)

- A certification guideline: 'the need for feedback provision to the learner'

Guideline examples of use

The following example of an answer to a self-assessment question, shows how to state the educational goals, how to offer a reward to the student who has solved the exercise indicating the level of difficulty. It offers a way out of a bottleneck using the guide for further study.

Answer to Self-Assessment Exercise 2.1

This exercise is designed to familiarize you with the design of control charts for quality control services in accordance with the standard ISO17000, taking into account the need for feedback.

The first step you should do to solve the exercise is to ...

If you managed to draw the diagram correctly, you succeeded in the most difficult point of the exercise, designing the feedback process; This means that you now are familiar with a key aspect of quality control.

This exercise was a bit difficult. If you did not succeed, do not worry, you probably need to give a little more time to develop your ability to analyze processes. You may do one repetition of section 2.1.1 emphasizing on example 2.2. In the guide for further study, you may find additional information in Chapter 2 of references 2 and 3 which analyze many similar examples.

It is important to try to understand the basic principles of diagram design because they are considered essential elements of audit processes. You will also need them in the next chapters which deal with non-deterministic quality assurance techniques.

Learning model Overview– Educational content – an example (4/5)

- A certification guideline: 'the need for feedback provision to the learner'

Guideline examples of use

The next example is a response to an Activity. It analyzes the key points of the response and provides feedback.

Answer to Activity 5.8

In this activity you were asked to analyze briefly the vision of light according to Plato, by reading Bibliographic reference 1.

The work of Plato is of great importance, since it is considered by many....

If your answer spotted these 4 main points of Plato's vision then you are on the right track! If you did not manage to find them all, maybe you should read again more carefully section 3.1. After completing the activity, you may be interested in reading the 4th Chapter as well, for more information on how Plato laid the foundations for the Renaissance endorsements of light. A critical examination of the Platonic view and variations through time (with particular emphasis on the culture of the 20th century) can be found in the Guide for further study.

Remarks on the method used:

The last paragraph enhances the activity stirring the interest of students. It is important that activities are motivating students to further research into an object using the Guide for Further Study included in the content.

Learning model Overview– Educational content –an example (5/5)

- A certification guideline: 'the need for feedback provision to the learner'

Guideline Remarks

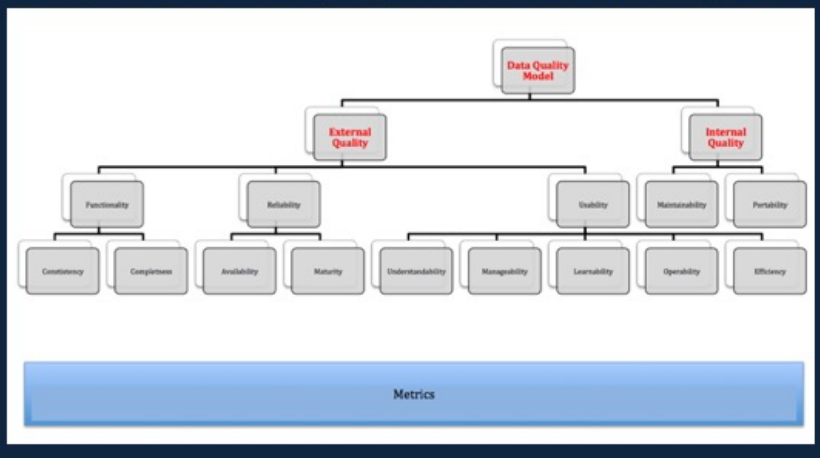
1. It is important to provide an effective way out of an educational bottleneck, particularly if this bottleneck is associated with a significant learning goal. Re-reading the same content without instructions, is usually not enough. Using the Guide for Further Reading and/or additional sources of information is more appropriate.

2. The solution should emphasize on any difficult points, analyzing them in more detail.

3. The author should design the content so that all of its components (learning objectives, main study content, evaluation and feedback mechanisms, further study) are closely linked. Any loose connection between them reduces significantly the educational impact.

Learning model Overview– Educational content – certification/standardisation

ISO25000 based, Educational data Quality Model for Distance Learning - Structure



Learning model Overview– Educational content – certification/standardisation

ISO25000 based, Educational data Quality Model for Distance Learning - Metrics

Metric Title	Goal	Appliation method	Measurement method	Στοιχεία υπολογισμού	Measurement scale	Life cyce	Stakeholders
Number of examples per section	How many examples are given per sections	The number of distinct examples that exist in each educational unit	X = Number of examples of new concepts that are measured in each educational module	0 <= X X= count	Absolute	• Design • Develop • Evaluate	• Specifications Team • Development team • Internal Evaluators

Upper, lower bounds are defined -> best practice

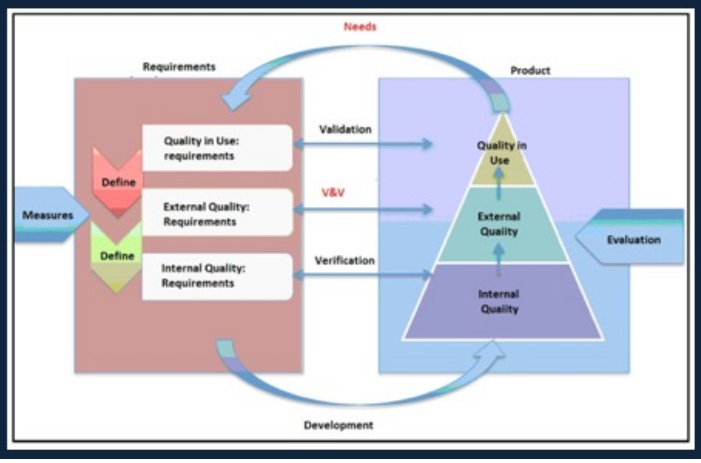
Learning model Overview– Educational content – certification/standardisation - template

ISO25000 based, Educational data Quality Model for Distance Learning

TB2: COURSE UNIT (LEARNING ACTIVITY) DESCRIPTION		
1	Unit title	*Title of Unit*
2	Unit code	*Unit code (should be consistent and should reflect the corresponding module)*
3	Unit description	*Description of the Unit (learning activity) (up to 100 words)*
4	Educational strategy	*Description of the educational strategy (e.g. presentation, role playing, case study) will be adopted for the specific unit (learning activity)*
5	Learning outcomes (LOut)	*Record the Learning Outcomes for the specific unit. Use TB2.1.*
6	Unit core material (Learning object (LO)) (code and title)	*List of Learning objects (videos, presentations, etc.) included in the specific unit (codes should be consistent and should reflect the corresponding unit)*
7	Unit additional material (code and title)	*List of additional material (e-books, additional readings, etc) included in the specific unit (codes should be consistent and should reflect the corresponding unit)*
8	Collaboration objects (code and title)	*List of Collaboration objects (e.g. forum) included in the specific unit (codes should be consistent and should reflect the corresponding unit)*
9	Assessment objects (projects, self-evaluation exercises, etc.) (code and title)	*Detailed description of the learners' assessment for the specific unit (codes should be consistent and should reflect the corresponding unit)*
10	Unit schedule	*Description of the educational path for the defined unit*
11	Key words	*Key words (3 to 10)*

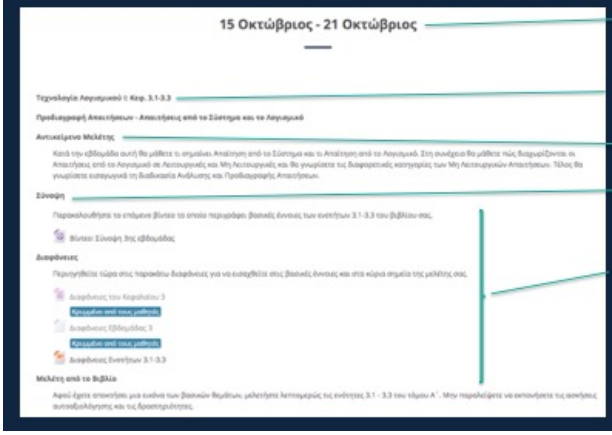
Learning model Overview– Educational content – certification/standardisation - template

ISO25000 based, Educational data Quality Model for Distance Learning- Process Life cycle



Learning model Overview– Educational content –Other formats

- Video lectures (embedded in the Learning Management System)



Week

Section within textbook

Educational goals

Synopsis

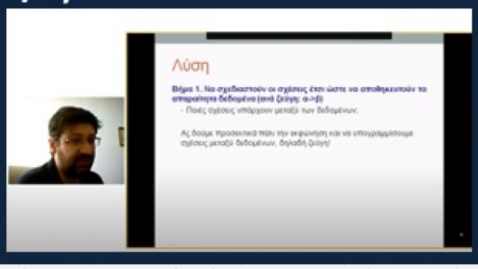
Learning path
1. Watch the video
2. Read additional material
3. Self assessment exercises

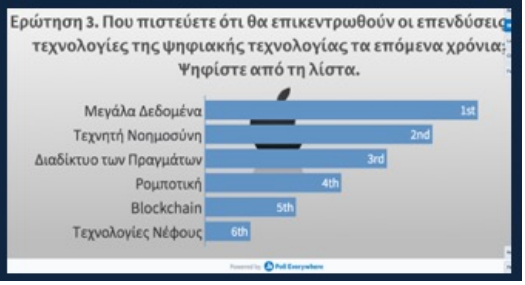
Learning model– F2F sessions (1/2)

- 5 face to face sessions
- Duration: 4 hours each
- Goals:
  - To discuss questions on the educational material
  - Not a lecture session, although it turns out as such
- Takes place in a city near the residence of students of a group
  - (groups of students are formed based on their place of residence)
- Means: Powerpoint presentations, discussions

Learning model– F2F sessions (2/2)

- COVID19: Virtual Meetings (many things are lost…)
- Some good practices:
  - Keep tutor camera open
  - Engage in discussions after each major topic using examples
  - Most students do not like to talk but they will be engagement via collaboration tools
  - Presentations should be tailored for online learning





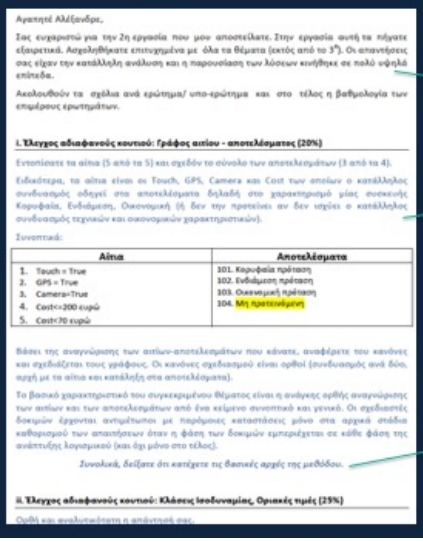
Learning model– Laboratories

- Some courses include laboratory units
- Most laboratory courses are live
- They take place each August
- Students need to travel to HOU headquarters
- Some are held on line

Learning model– Assessment (1/3) - Assignments

- 4-5 Assignmment per Unit per year (30% of final score)
- Students have about 1,5 month to submitt their answers
- Assignments are individually performed
- They are carefully linked to the educational objectives of subject taught
- Upon submission
  - Indicative solutions are published
  - Tutors submitt individual comments and score within 15 days
- The LMS is used.
- There are best practice guides for commenting assignments

Learning model– Assessment (2/3) - Assignments



Αγαπητέ Αλέξανδρε,

Σας ευχαριστώ για την 2η εργασία που μου αποστείλατε. Στην εργασία αυτή τα πήγατε εξαιρετικά. Ασχοληθήκατε επιτυχημένα με όλα τα θέματα (εκτός από το 3ο). Οι απαντήσεις σας είχαν την κατάλληλη ανάλυση και η παρουσίαση των λύσεων κινήθηκε σε πολύ υψηλά επίπεδα.

Ακολουθούν τα σχόλια ανά ερώτημα/ υπο-ερώτημα και στο τέλος η βαθμολογία των επιμέρους ερωτημάτων.

i. Έλεγχος αδιαφανούς κουτιού: Γράφος αιτίου - αποτελέσματος (20%)

Εντοπίσατε τα αίτια (5 από τα 5) και σχεδόν το σύνολο των αποτελεσμάτων (3 από τα 4).

Ειδικότερα, τα αίτια είναι οι Touch, GPS, Camera και Cost των οποίων ο κατάλληλος συνδυασμός οδηγεί στα αποτελέσματα δηλαδή στο χαρακτηρισμό μίας συσκευής Κορυφαία, Ενδιάμεση, Οικονομική (ή δεν την προτείνει αν δεν ισχύει ο κατάλληλος συνδυασμός τεχνικών και οικονομικών χαρακτηριστικών).

Συνοπτικά:

Αίτια	Αποτελέσματα
1. Touch = True 2. GPS = True 3. Camera=True 4. Cost<=200 ευρώ 5. Cost<70 ευρώ	101. Κορυφαία πρόταση 102. Ενδιάμεση πρόταση 103. Οικονομική πρόταση 104. Μη προτεινόμενη

Βάσει της αναγνώρισης των αιτίων-αποτελεσμάτων που κάνατε, αναφέρετε του κανόνες και σχεδιάζεται τους γράφους. Οι κανόνες σχεδιασμού είναι ορθοί (συνδυασμός ανά δύο, αρχή με τα αίτια και κατάληξη στα αποτελέσματα).

Το βασικό χαρακτηριστικό του συγκεκριμένου θέματος είναι η ανάγκης ορθής αναγνώρισης των αιτίων και των αποτελεσμάτων από ένα κείμενο συνοπτικό και γενικό. Οι σχεδιαστές δοκιμών έρχονται αντιμέτωποι με παρόμοιες καταστάσεις μόνο στα αρχικά στάδια καθορισμού των απαιτήσεων όταν η φάση των δοκιμών εμπεριέχεται σε κάθε φάση της ανάπτυξης λογισμικού (και όχι μόνο στο τέλος).

Συνολικά, δείξατε ότι κατέχετε τις βασικές αρχές της μεθόδου.

ii. Έλεγχος αδιαφανούς κουτιού: Κλάσεις ισοδυναμίας, Οριακές τιμές (25%)

Ορθή και αναλυτικότητα η απάντησή σας.

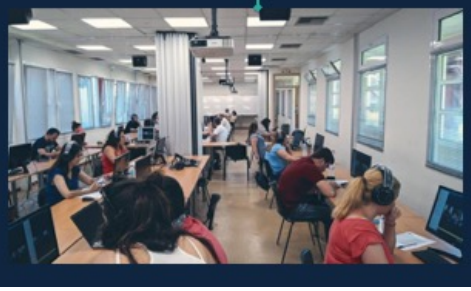
Summary and encouragement.

Detailed comments per answer

Summary of answer

Learning model– Assessment (3/3) – Final exams

- Final exam (70% of final score)
- Live exam
- During COVID19, online exams

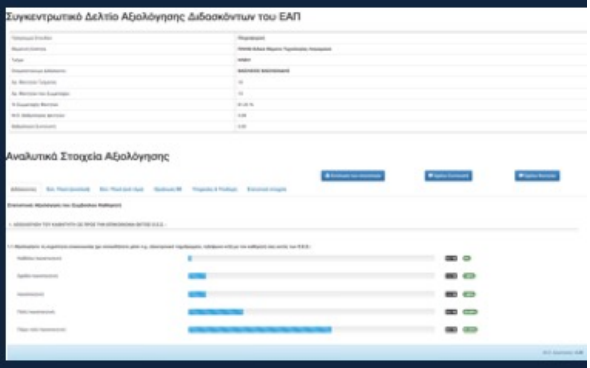


Learning model– Theses

- Duration: 1 academic year
- Individual assignments
- 1 tutor is responsible
- A committee is formed (3 members)
- 4 reports need to be delivered in specific dates
- The 4th report is the Theses
- An examination session takes place where the theses is defended against the committee.

Learning model– Quality Assurance

- Students evaluate:
  - Their tutor
  - The Educational material
  - Institutional services
  - Anonymoysly in April-May. Results are published in September.
- Tutors evaluate:
  - The tutor coordinator
  - The Educational material
  - Institutional services



Student evaluation is taken into account (10%) in the contract assessment of tutors each year

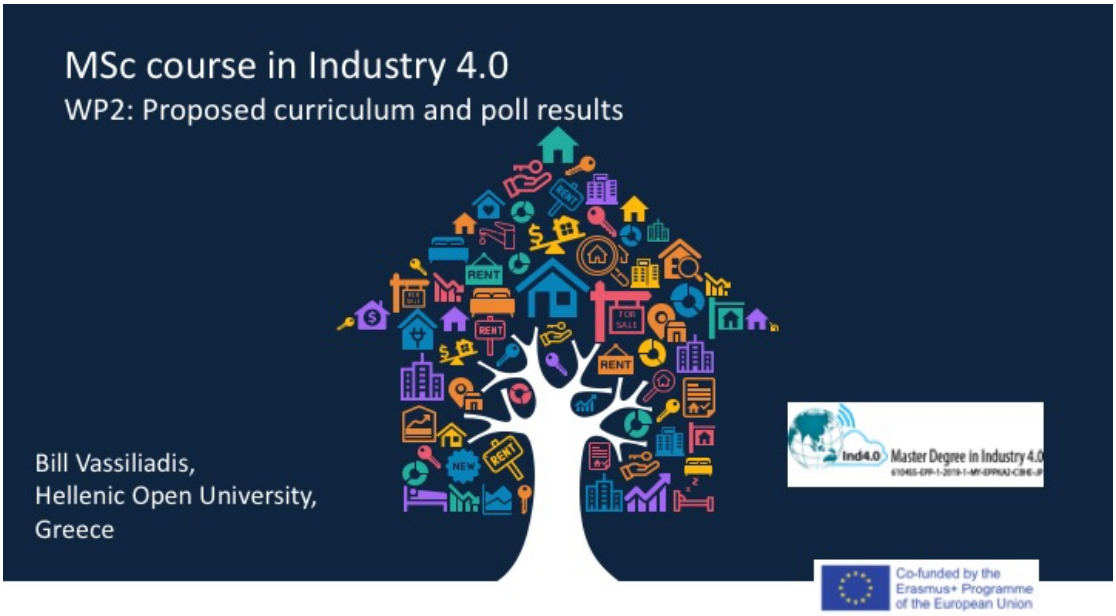
Contents

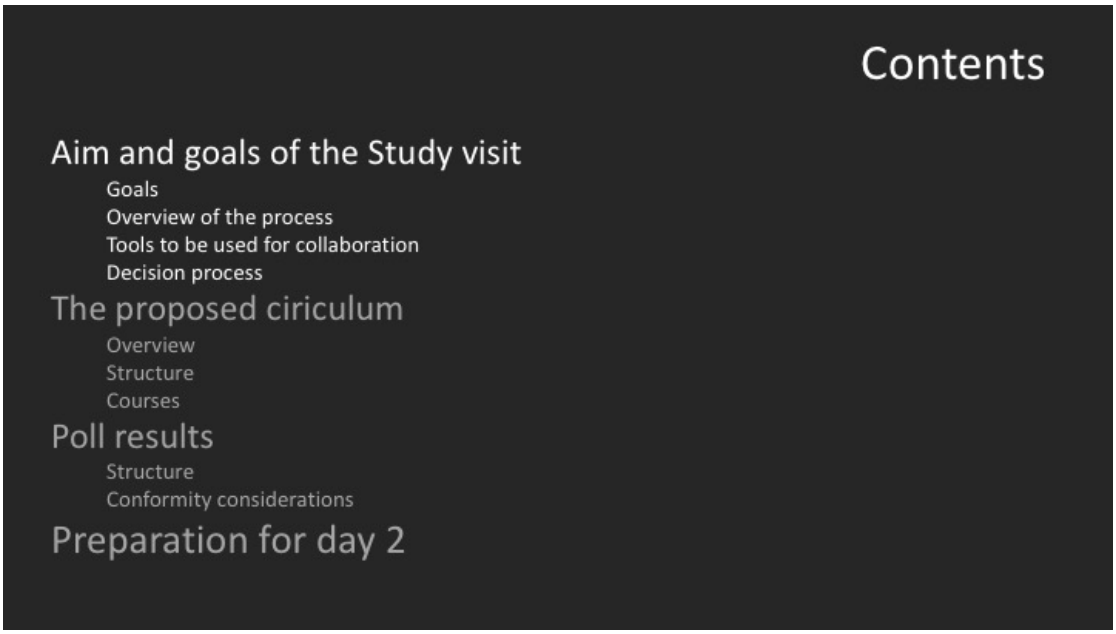
Conclusions (accordning to HOU's experience)

In distance learning:

- The learning process may be incorporated in the content
- Specialised content should be used
- Provide timetable for study load
- Compensate for the 'disapearing tutor'
- Blended model of assessment

ANNEX III – Poll Results





Aim and goals of the study visit

Aim:

- to exchange knowledge and good practices from running Industry 4.0 related post-graduate courses in EU HEIs and
- decide on core aspects of the Industry 4.0 curriculum.

Goals:

- Design of the structure of the curriculum
- Discussion over various actors affecting the delivery of the MSc course
- Design of the high level description of the courses

Overview of the process

Basis:

- The Technical Annex
- The proposed curriculum
- The poll results
- The work done in this study visit

Decide on:

- the profile of the students
- the final structure of the curriculum
- High level description of the courses

How:

- Decisions will be taken by all, all partners participate
- Take into account regulatory issues and HEIs' capabilities

Overview of the process - Methodology

1st day

- Overview of proposal and initial comments

2nd day

- Decide on general aspects of the MSc
- Organisation in WGs

3rd day

- WGs: describe courses (high level description)


Study Visit Programme

It is important that each partner is informed before hand on the requirements

Barriers/Risks

Communication barriers:

- We need to understand what the TA requires
- Each partner should communicate effectively existing barriers (regulatory issues, institutional capacity etc.)
- Partners are NOT aware of institutional/national regulations and restrictions. So please explain when necessary.

The final result should be able to pass the accreditation process in partner institutions

Decision process:

- Use on line tools to save time

Mitigation process

IF a final decision cannot be reached for any of the issues:

THEN (it is proposed to)

We shall use the interval between the 1st and the 2nd study visit to reach a consensus.

A realistic goal would be to reach a decision on the general aspects of the MSc programme

Contents

Before we start

Please keep in mind:

- The curriculum to be presented is a proposal, just to have something to jumpstart the discussion
- NO decision has been taken on anything yet
- The TA describes the curriculum but it is just a proposal, it can be tailored

Structure (as in per TA)

Title: MSc in Industry 4.0

Awards: 90 ECTS

Duration:

- 18 months (full time)
- 24 months (part time)

No of semesters: 4

Application sectors (specialization):

1. Industry 4.0 for Manufacturing,
2. Agriculture 4.0/Aquaculture 4.0 and
3. Pervasive Health services.

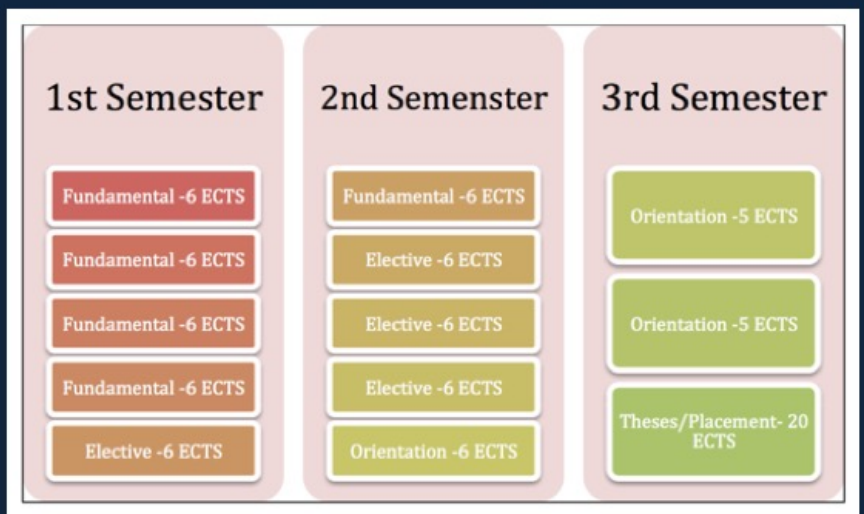


Figure 1. Type of courses per semester and ECTS distribution

Semester	Elective Courses	Total number of elective courses to be described
1st	Choose 1 out of 2 available	2
2nd	Choose 3 out of 5 available	5
3rd	-	0

Table 1. Total number of elective courses offered per semester

Semester	Orientation Courses	Total number of Orientation courses to be described
1st	-	0
2nd	1 per Application Area	3
3rd	2 per Application Area	6

Table 2. Number of orientation courses offered per semester

Semester	Number of Courses (including options)
1st	6
2nd	9
3rd	6
VET	3
Total	**24**

Table 3. Total number of courses to be described

Things to consider:

- There are 3 specialization paths
- For each course, we need to prepare description and content
- Thus, a limit must be set

1st Semester	ECTS
4 FUNDAMENTAL COURSES	24
1 OUT OF 2 AVAILABLE ELECTIVE COURSES	6
6 COURSES	30

2ND Semester	ECTS
1 FUNDAMENTAL COURSE	6
3 ELECTIVE COURSES OUT OF 5 AVAILABLE	18
1 ORIENTATION COURSE PER APPLICATION AREA	6
6 COURSES	30

3rd Semester	ECTS
2 ORIENTATION COURSES PER APPLICATION AREA	10
THESES/PLACEMENT	20
2 COURSES + 1 THESES/PLACEMENT	30

1st Semester				
Code	**Course Title**	**Course Type**	**Application Area**	**ECTS**
IND101	Big data analysis in Industry 4.0	F	All	6
IND102	Networking Technologies and Sensors	F	All	6
IND103	Artificial Intelligence	F	All	6
IND104	Industry 4.0 cyber-physical Systems Engineering	F	All	6
IND105	Cloud Computing Services and Technologies	F	All	6
IND106A	Digitalization of enterprises and business models	E	All	6
IND106B	Entrepreneurship, funding and innovation management	E	All	6

2nd Semester				
Code	**Course Title**	**Course Type**	**Application Area**	**ECTS**
IND201	Cybersecurity of networks and cyber-physical systems	F	All	6
IND202	Advanced industrial and service robotics	E	All	6
IND203	Smart Factory Technologies and Concepts	E	All	6
IND204	User interfaces for Industry 4.0	E	All	6
IND205	Optimization and Intelligent Systems	E	All	6
IND206	Robotics and Industry 4.0	E	All	6
IND207A	Sustainable Product Design & Manufacturing	O	Manufacturing	6
IND207B	Agriculture/ Aquaculture system design	O	Agriculture 4.0/Aquaculture	
IND207C	Biosensors	O	Pervasive Health	

3rd Semester- Manufacturing Application Area			
Code	**Course Title**	**Course Type**	**ECTS**
IND301A	Thesis	F	20
IND301B	Placement	F	20
IND301	3D printing	O	5
IND301	Modeling, Digital Twins and Simulation	O	5

3rd Semester- Agriculture 4.0/Aquaculture 4.0. Application Area			
Code	**Course Title**	**Course Type**	**ECTS**
IND301A	Thesis	F	20
IND301B	Placement	F	20
IND301	Autonomous robots	O	5
IND301	Ecosystems for optimised/precision farming/aquafarming	O	5

3rd Semester- Pervasive Health Application Area			
Code	**Course Title**	**Course Type**	**ECTS**
IND301A	Thesis	F	20
IND301B	Placement	F	20
IND301	Biosensors	O	5
IND301	Health Information Management and Pattern recognition	O	5

VET Courses		
Code	**Course Title**	**Durations (in hours)**
INDVET1	Introduction to Manufacturing 4.0	4
INDVET2	Introduction to Agriculture/Aquaculture 4.0	4
INDVET3	Introduction to Pervasive Health/ Health 4.0	4

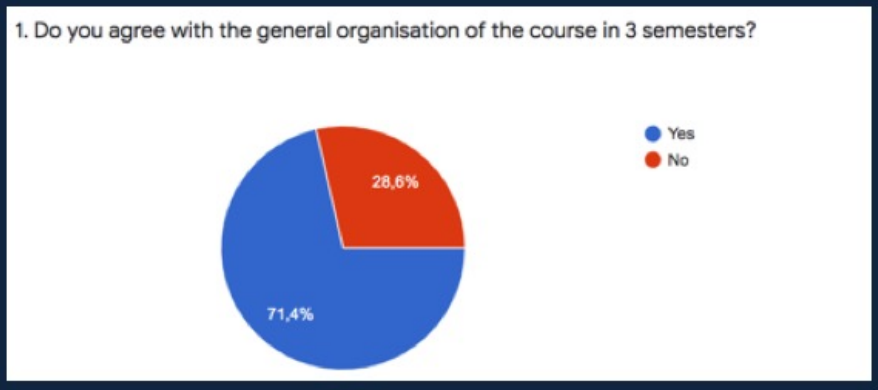
Other requirements (as in per TA)

- **Mode of delivery: blended**
- **Entry requirements:** Candidates who have a Bachelor's degree in Engineering, Sciences or Informatics will take precedence.
- **Master Theses/Placement:**
  - a Master thesis pathway (research-based) and
  - a non-Master thesis pathway (placement)

Contents

Poll results- structure

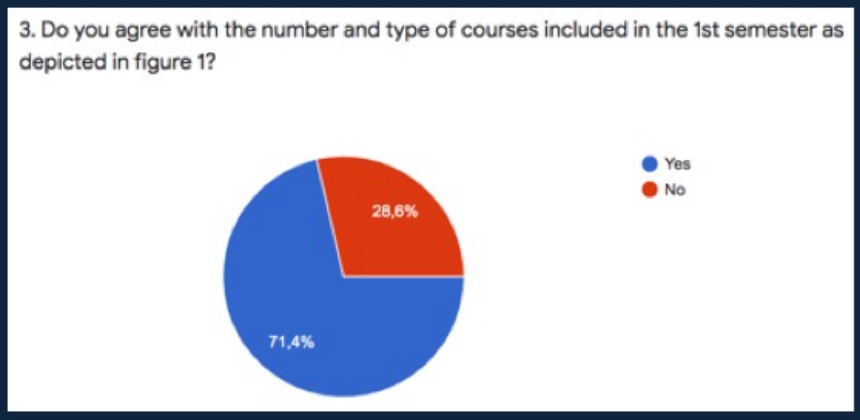
- No of answers: 7 /12 HEIs (16 partners in total)



Poll results- structure

- Other suggestions:
  - 4 semesters, 5 courses per semester, 17 ECTS per semester
  - 4 semesters. For the semester 1 to 3 for the theory courses and the 4ht semester for the research thesis.

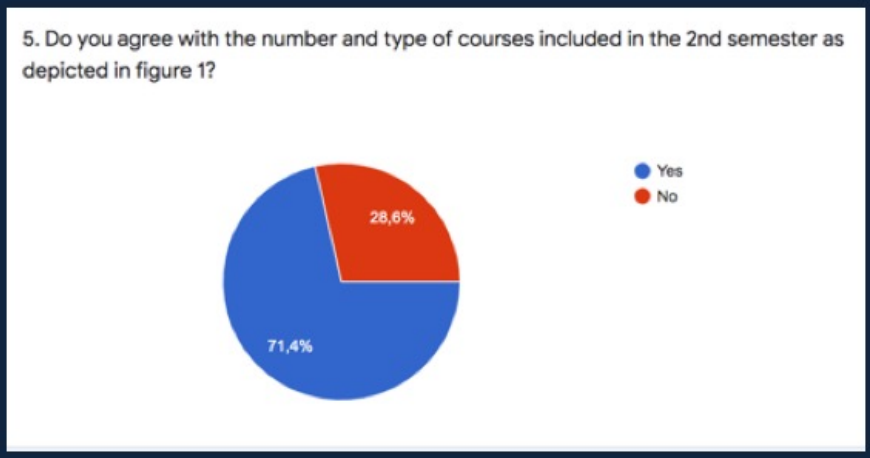
Poll results- structure- 1st semester



Poll results- structure 1st semester

- **Other suggestions:**
  - 3 fundamental courses and 1 elective course, total 24 ECTS
  - deleting the possibility for the students to make a choice in the first 2 semesters (thus we suggest having all compulsory courses)
  - we suggest unifying 106 A - e 106B or deepening the 106B with a cross global approach (international/global entrepreneurship through global standards),
  - we suggest changing the sequence: 102, 101, 103

Poll results- structure 2nd semester



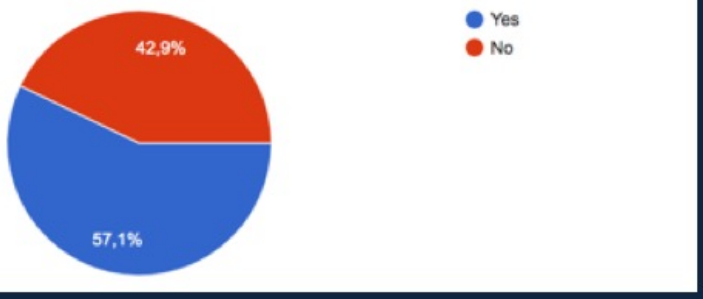
Poll results- structure 2nd semester

Other suggestions:

- 2 fundamental courses, 2 elective courses, total 24 ECTS
- it is not clear if the courses the students have to choose have the same deepness, one students would attend a vertical course, another an horizontal one, too different approaches, if the number of credits is the same, the course has to be the same deepness.

Poll results- structure 3rd semester

8. Do you agree with the number and type of courses included in the 3rd semester as depicted in figure 1?



Poll results- structure 3rd semester

Other suggestions:

- Elective course, 3 orientation courses, total 22 ECTS
- The course about biosensor is already mentioned in the second semester. 2. Biosensor in the second semester should be replaced by a course less specific.
- the number of credits seems to be not enough for such orientation courses such important.
- The proposed subjects seems to be too much specific (too vertical approach) e.g. 3D printing.
- We would suggest to enlarge the themes without focusing on peculiar subjects.
- Thesis/placement only. The orientation will be replaced with seminar.

Poll results- structure Comments

Other suggestions:

- in addition to fundamental, electives and orientation courses, Malaysia universities normally imposed one (1) "compulsory university subject".
- 4th Semester only thesis (20 ECTS) with total 90 ECTS in 4 semester
- The total credit hours must comply with Malaysian Qualification Agency and must be competitive with other Master programmes in Malaysia.
- Base on the Cambodia Qualification Framework, the total minimum credits for master degree are 45 Credits (Appropriate the minimum 675 hours). In this mean, I suggest conduct 15 subjects with 45 credits (1 subject = 3 credits) and 12 credits (180 hours) for the research thesis.

Poll results- Other fundamental courses to be included

Other suggestions:

- Edge computing (to be included into embedded systems)
- Research Method
- Statistic for research and Advance Java Programming

Got few votes:

- Embedded systems
- Automation of industrial processes

Poll results- Other elective courses to be included

Other suggestions:

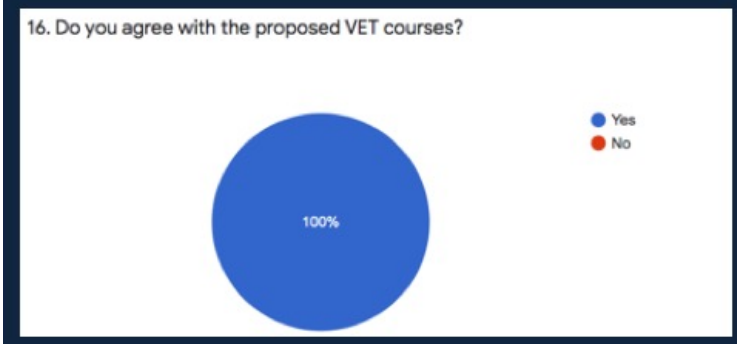
- Digital services for the enterprises
- Audit Technology
- Entrepreneurship, funding and innovation management
- Software engineering and advance network

Poll results- Other orientation courses to be included

Other suggestions:

- Telemedicine (data analysis for medicine)
- Health Information Management and Pattern recognition
- Health informatics management.
- Mobile communication technology

Poll results- VET courses



Perhaps we can add one general topic for VET such as Introduction to Industry 4.o and its implication to Nations' Economic and Sustainability.

Poll results- Final comments

- We are concern on number of semesters as we need to follow our university academic regulations.
- Minor revision in terms of credits per semester in order to comply with Malaysian Qualification Agency.
- We need to develop the course for EU site differ Asian site. I suggest to develop course program base on the National Qualification Framework of different country.

Contents

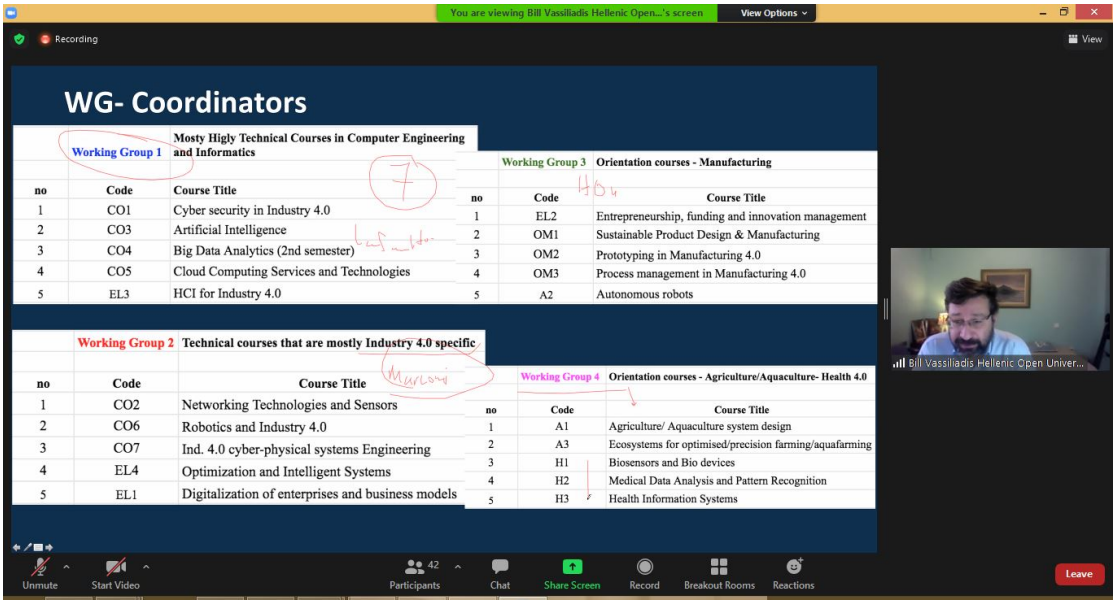
Time and (virtual) place

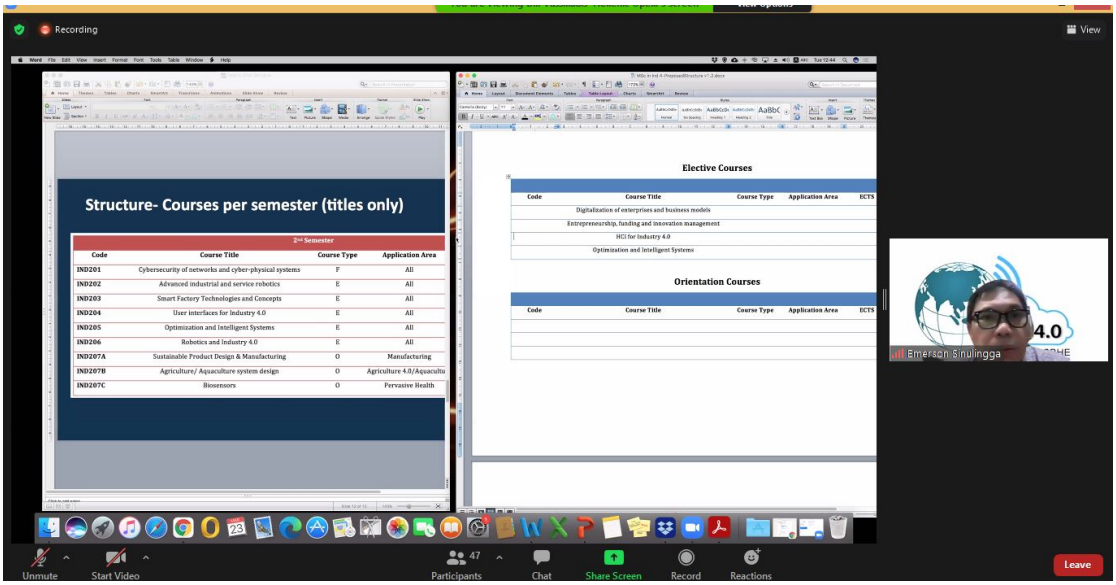
2nd Day:
Same time: 09:00 CET
Same place: same zoom link

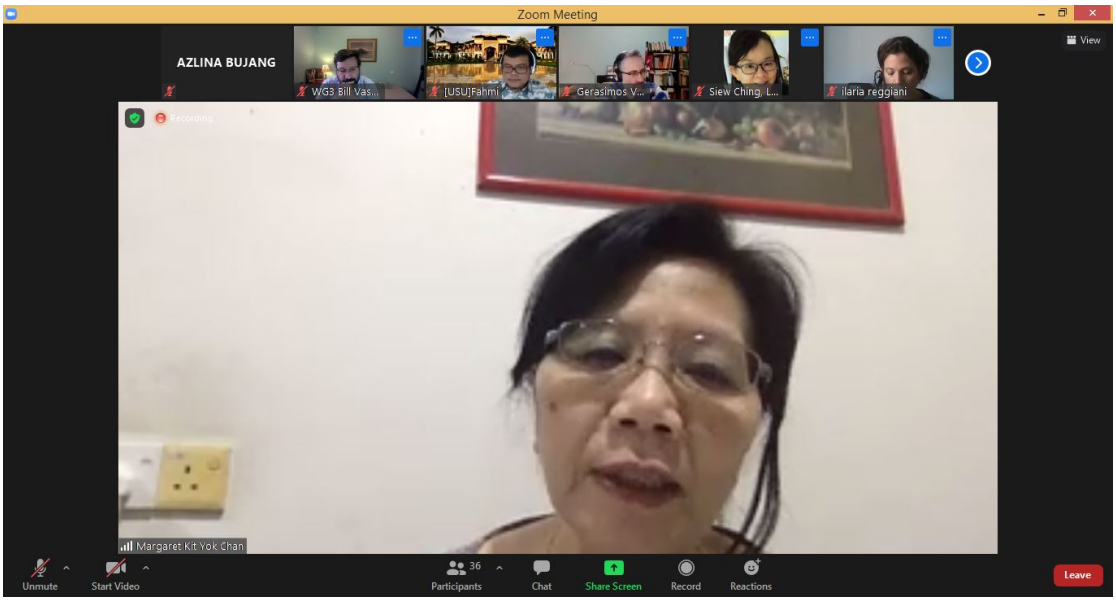
Preparation: Please come prepared
- Check the issues to be discussed
- Formulate an initial position according to your needs
- Write down questions (if you send it through BS before the meeting it would help)

- Collaboration tool:
  - pollev.com/billvassilia852

ANNEX IV – Screenshots from the 1st Study Visit




Recording
View
Structure- Courses per semester (titles only)
2nd Semester
Code
Course Title
Course Type
Application Area
IND201 Cybersecurity of networks and cyber-physical systems F All
IND202 Advanced industrial and service robotics E All
IND203 Smart Factory Technologies and Concepts E All
IND204 User interfaces for Industry 4.0 E All
IND205 Optimization and Intelligent Systems E All
IND206 Robotics and Industry 4.0 E All
IND207A Sustainable Product Design & Manufacturing O Manufacturing
IND207B Agriculture/ Aquaculture system design O Agriculture 4.0/Aquacultu
IND207C Biosensors O Pervasive Health
Elective Courses
Code
Course Title
Course Type
Application Area
ECTS
Digitalization of enterprises and business models
Entrepreneurship, funding and innovation management
HCI for Industry 4.0
Optimization and Intelligent Systems
Orientation Courses
Code
Course Title
Course Type
Application Area
ECTS
Emerson Sinulingga
Unmute
Start Video
47
Participants
Chat
Share Screen
Record
Reactions
Leave


Zoom Meeting
View
AZLINA BUJANG
WG3 Bill Vas...
[USU]Fahmi
Gerasimos V...
Siew Ching, L...
Ilaria reggiani
Recording
Margaret Kit Yok Chan
Unmute
Start Video
36
Participants
Chat
Share Screen
Record
Reactions
Leave