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Euro-Asian Collaboration for Enhancing STEM Education

Siegfried Rouvrais, Gilles Jacovetti, Charlotte Langlais, Philippe Lenca, Doan Van Dien, Duong Van Hieu, Bui Van Hong, Le Tan Cuong, Tran The Van, Arlinta Barus, et al.

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EASTEM

EURO-ASIA COLLABORATION FOR ENHANCING STEM EDUCATION

EASTEM project report, deliverable D4, February 2022

Euro-Asian Collaboration for Enhancing STEM Education

EASTEM WP4: Industry engagement and competence integration into STEM educational programs

Deliverable D4

version 1.0, February 2022



Preamble

EASTEM is a capacity-building project funded by Erasmus+ (KA2) with the aim of improving employability of STEM graduates from partner universities by ensuring students acquire skills needed in the workplace. Over the course of 3 years (2019-2022) and with a budget of 999.000 EUR, the project brings together 3 universities from Europe and 10 from Asia, creating a platform for partner universities to exchange best practices on student-centered and competency-based STEM education.

The EASTEM project is co-funded with support from the European Commission, project (number 598915-EPP-1-2018-1-SE-EPPKA2-CBHE-JP) under the Erasmus+ program. This document reflects only the views of the authors. The Commission is not responsible for any use that may be made of the information contained therein. This document and its annexes in their latest versions are available from the EASTEM website (www.eastemproject.eu).

EASTEM Work Package 4 (WP4) is to facilitate industry engagement and competence integration into educational programs. Building on good case practises from all partner institutions, IMT Atlantique guided partners on how to integrate competence development for students into STEM education programmes and university strategies by engaging with

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programme leaders, deans, vice-rectors and rectors. This increased the capacities of partner institutions to offer education focused on students' needs and labour market requirements. With support on a strategic level from university management, STEM activities became more sustainable and partner institutions were better equipped to interact with corporate partners in the development of their STEM university education.

Simple tips are offered in this report, as some good practices shared, as a practical report. It does not offer complex theories or literature-driven discussion but some concrete strategies and practices EASTEM partners can put directly into practice to bridge the gap between industry and universities. In chapter 1, a baseline is formulated around foundations for competence integration. Chapter 2 provides collaborative insights on reforms and STEM program redesign rationales, as some recommendations. In chapter 3, some models and tools, elaborated with partner institutions, offer guidance to develop processes for continuous integration of competence development aspects into educational programs with industry collaboration. Finally, in chapter 4, competency orientation of STEM educational programs are discussed towards adaptation and transformation of STEM curricula.



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Dissemination model

| | |
|------------------------------------|---|
| Type | <input type="checkbox"/> Teaching material <input checked="" type="checkbox"/> Learning material <input type="checkbox"/> Training material <input type="checkbox"/> Event <input checked="" type="checkbox"/> Report <input checked="" type="checkbox"/> Video <input type="checkbox"/> Service/Product |
| Languages | English |
| Target groups | <input checked="" type="checkbox"/> Teaching staff <input type="checkbox"/> Students <input type="checkbox"/> Trainees <input checked="" type="checkbox"/> Administrative staff <input type="checkbox"/> Technical staff <input type="checkbox"/> Librarians <input checked="" type="checkbox"/> Other: <i>University Management</i> |
| Dissemination level | <input checked="" type="checkbox"/> Department / Faculty <input checked="" type="checkbox"/> Institution |
| Lead Organisation | WP4 coordinator: IMT Atlantique |
| Participating Organisations | ASEAN partners: CMU, HCMUTE, HUS, ITB, ITD, MU, PSU, UGM, UNUD, UTEHY European partners: IMTA, VU, UU |

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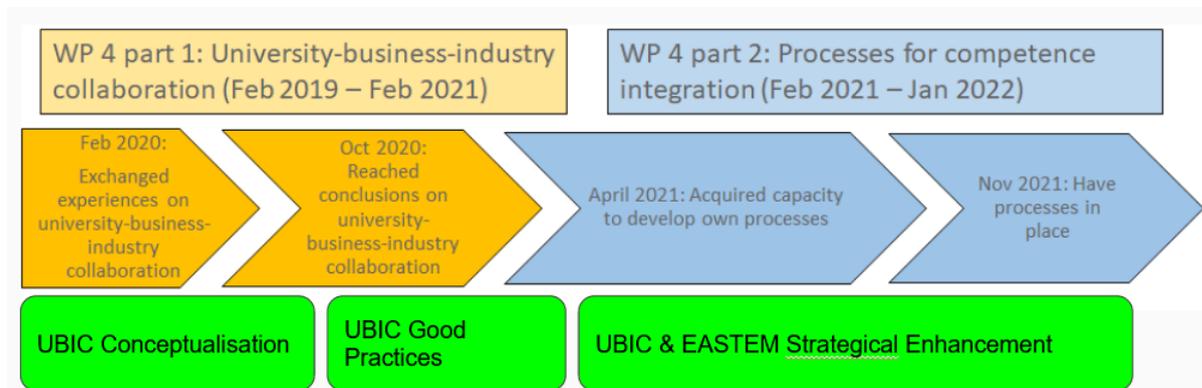
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Introduction

Sustainable Development Goal (SDG) number 4¹ states that the overarching goal of Education 2030 is aimed at ensuring inclusive and equitable quality education, and promoting lifelong learning opportunities for all. In Science, Technology, Engineering and Mathematics (STEM) Higher Education (HE), Technical and Technological Universities are increasingly faced with the challenges and tensions of developing the competencies and employability of their graduates, which has been further exacerbated by the global pandemic (García-Morales, et al., 2021; Govindarajan & Srivastava, 2020; Mishra, et al., 2020).

During the last decade, considerable emphasis has been placed on designing educational programmes and courses to develop the core and transversal skills and capabilities of future engineers and professionals, largely within a stable context. The WP4 EASTEM timeline was pressured by the 2020 pandemic on these employability and industry collaborations formats and opportunities.



At a more systemic level, it is critical to identify best practices regarding curriculum transformation processes in the context of a volatile, uncertain, complex and ambiguous (VUCA) world (Krishnamurthy, 2020), and examine the international curriculum and programme diversity. Krishnamurthy (2020: 2) argues that the “move to emergency remote teaching due to COVID-19 provides a discontinuous disruption to business-as-usual” and that it is critical to “unbundle and re-invent teaching, learning, assessment and certification”.

Method

In the EASTEM project, IMT Atlantique guided discussions on how to integrate professional competences into educational programs and reinforce industry collaborations. Going

¹ <https://www.un.org/sustainabledevelopment/education/>

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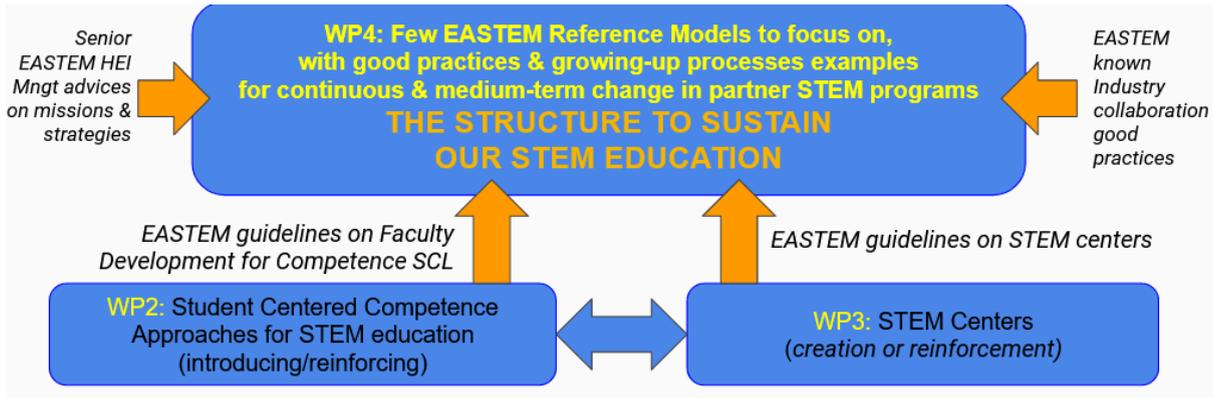
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beyond curriculum development and recognising the importance of competence development for students, this helped to bring competence development integration to a strategic level.



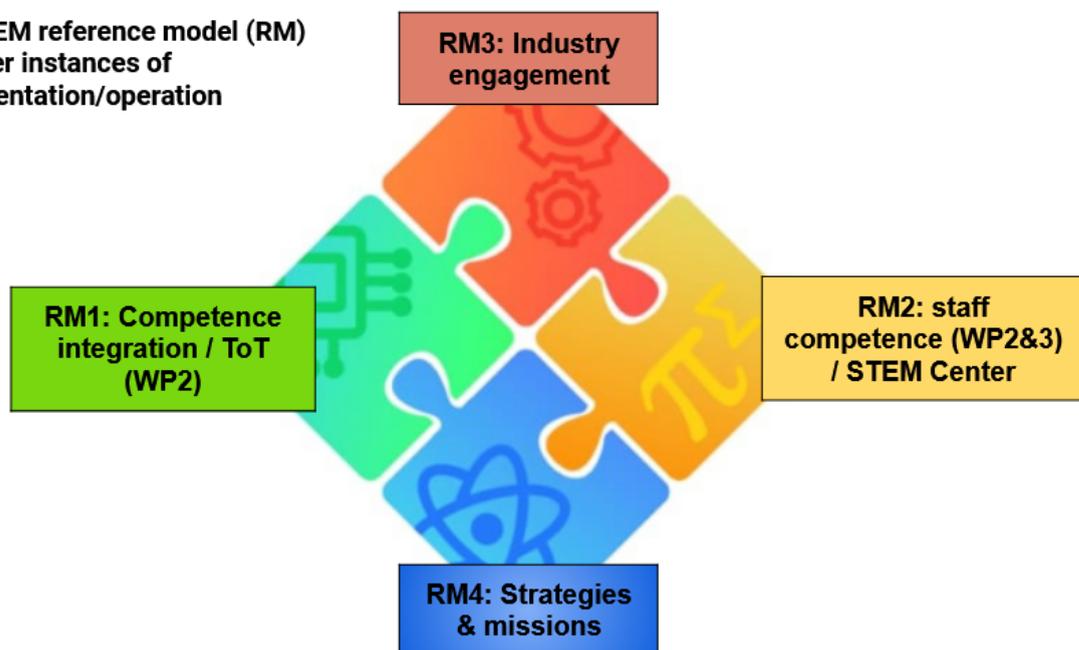
The EASTEM WP4 provided partner institutions with the knowledge to develop their own processes for continuous integration of competence development aspects into STEM educational programs. Accessing university management (Deans, Vice deans etc) to discuss and improve the connection between university governance, student centered competence development and industry involvement, and how to update or modify existing university strategies towards creating professional competence integrated education of a high quality.

| EASTEM focus or reference model (def/vision/TG) | Themes & Activities | Maturity levels & evidence of compliance (QA plan WP5) | Good practices identified in EASTEM, exemplar results | Potential obstacles for EASTEM partner integration | Actions plans and directions of 'each' EASTEM partners (milestones) |
|---|---------------------|--|---|--|---|
| RM1: Competence integration (WP2) | | | | | |
| RM2: Faculty competence/ STEM Center (WP2&3) | | | | | |
| RM3: Industry engagement | | | | | |
| RM4: Strategies & missions | | | | | |



1. RM1: Competency Integration - relates to processes & methods in place at programme or university level to meet the Student Learning Centered approach defended in WP2, with an explicit plan & actions to integrate personal and interpersonal skills, and professional skills;
2. RM2: Faculty Competence - relates to processes & methods in place at programme or university level to meet the STEM Center approach defended in WP3, with an explicit plan & actions to enhance faculty STEM competence, inc. professional and teaching skills;
3. RM3: Industry Engagement - relates to processes & methods in place at programme or university level to support industry engagement, links to employability, and interact with corporate partners, with an explicit plan & actions to integrate industry presence in the curricula to meet required professional skills;
4. RM4: Mission & Strategy - relates to processes & methods in place at programme or university management level to facilitate the enhancement on RM1, RM2 and RM3 maturity, with an explicit plan & actions to engage in continuous improvement with deans, vice-rectors and rectors, and RM1, RM2, and RM3 stakeholders (e.g. faculty & teaching staff, programme designers, industrial partners).

**1 EASTEM reference model (RM)
in partner instances of
implementation/operation**



There is a willingness to change the STEM education programs. The European and Asian partners had several fruitful discussion on how this to take place. With the knowledge exchanged through the partnership, each partner's expertise and experiences from different contexts have synergistically enriched each other. This includes developing strategies for enhancing each university's own STEM education system, to establish a



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platform for networking on STEM education, and to safeguard the pitfalls of education in rapid changes of science and technology.

Industry collaborations

The aim of this work package is to integrate the student-centered teaching approach and reinforce industry collaborations into the various STEM curricula of the partner universities. This was implemented by providing collaborative insights on reforms of STEM program redesign rationales, discussions, support and recommendations on processes, in order to structure new and innovative education STEM programs, linked with industrial opportunities. The Work Package increases the capacities of partner institutions to modernise their STEM educational programs and to offer high quality programs that focus on the students' needs and that meet future requirements by the labour market.

In realising the need for strategic support for student centered competence development with industry bridges, this WP engaged with university management and work to develop a strategy and process for continuous integration of competence development into educational programs. It led to a new way to interact with corporate partners in the development of university education.

Based on major STEM accreditation requirements in the six partner countries of EASTEM, several University-Industry collaboration formats were categorized in themes (Rouvrais et al, 2020):

- **UBIC-1: Industrial and Business partner's implication in STEM programme design, review & revision;**
- **UBIC-2: Industrial and Business partner's participation in STEM programme teaching & learning activities;**
- **UBIC-3: Professional work activities integrated in STEM curricula;**
- **UBIC-4: Graduate Employment & Employability Analysis at STEM Schools;**
- **UBIC-5: Students Preparation for Employment & Careers in STEM programme;**
- **UBIC-6: Financial aspects with Industry (strategic QA);**
- **UBIC-7: Innovation and R&D with Industry (functional QA);**
- **UBIC-8: Workspaces with Industry.**

These University-Industry collaboration formats laid the foundation of a structured relationship model for STEM universities, which now permits to build on good case practices from all partner institutions. It thus contributes to advancing STEM-educational frameworks for curriculum guidelines aligned with skills for industry. Going beyond concerns and models of an EASTEM educational framework, incl. curriculum development, SCL, industry collaboration, training of trainers and STEM centres, a more strategic level

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EASTEM project report, deliverable D4, February 2022 was to be reached. EASTEM aimed to provide partner institutions with the knowledge to develop their own processes for continuous integration of good practices into their STEM educational ecosystem. With support on a strategic level from university management, STEM activities are more sustainable.

As presented in an EASTEM video (<https://youtu.be/IMbM6E23fJA>), the framework is systemic.



IMT Atlantique, France engages with partners on how to better reach university management (e.g. programme leaders and deans, vice-rectors and rectors). They work to develop a strategy, canvas and maturity tools for continuous integration of competence development and EASTEM models into various levels of university education. Anchoring the need for support on a strategic level leads to sustainability of the various action plans, at short to longer terms.



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Chapter 1: Foundations for Competence Framework

In 2022, the HE sector needs more resilient curricula and systemic innovation that might not be instantly apparent. Marinoni van't Land and Jensen (2020) in their study emphasized “the important degree of stress and constraint currently experienced by higher education institutions around the world. Almost all institutions that responded to the survey are affected in a way or another by the COVID-19 crisis and the crisis has affected all institutional activities... the incredible amount of pressure on higher education institutions to cope during the current crisis and at the same time their resilience and creativity.” Taking into account the VUCA and multiple disruptions, STEM curricula are to become more adaptable, responsive, and resilient.

New skills are required in the era of the Fourth Industrial Revolution, now also for the post-COVID-19 era (or with-). As stated by Skills Development Scotland & Centre for Work-based Learning (2018), skills ‘serve as the bridge between knowledge and performance. (...) This bridge is every learner’s path to success’. From the perspective of STEM universities (Science, Technology, Engineering, and Maths) and engineering education institutions, it is crucial to meet new industry expectations in curricula. Institutions are to offer education focused on students’ needs but also labour market needs. For proactive alignment of STEM training models with industrial requirements, University-Business-Industry Collaboration (UBIC) is a top concern within educational frameworks.

Image 1. The EU and ASEAN in numbers



Source: European Commission, Mission of the European Union to ASEAN; World Bank, World Development Indicators.

In 2020, a European initiative suggested the Curriculum Guidelines 4.0 (PwC, 2020) to promote better cooperation between industry and education and training organisations. The focus is on the alignment of Advanced Manufacturing Technologies education and training with the needs of the New Industrial Age. Eight dimensions are considered, one is in collaboration in order to ‘promote practices that move beyond the typical institutional

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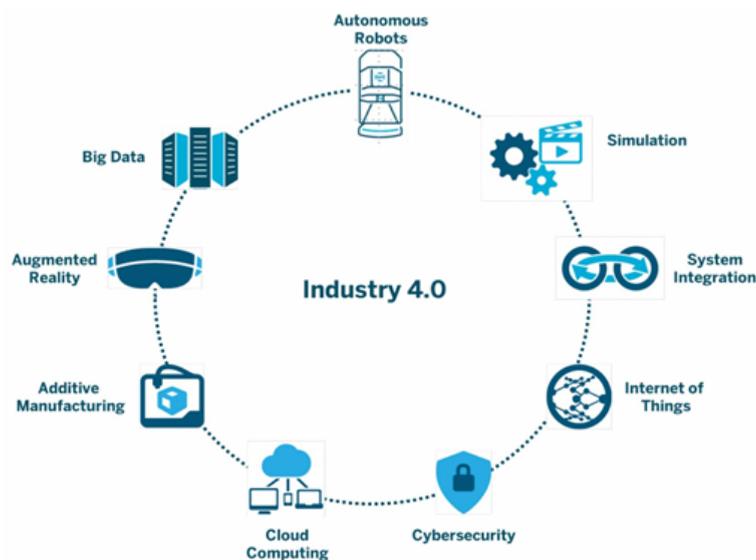
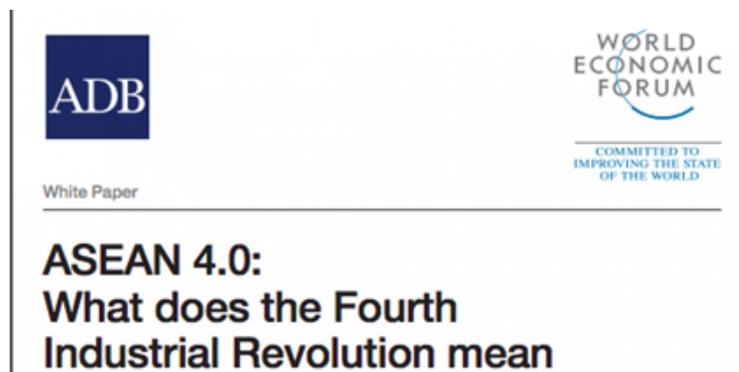


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collaboration patterns, by engaging individuals and communities “. The conceptual principles derived include the following: further increasing university-industry collaboration in terms of both volume and diversity of collaboration forms (e.g. internships/apprenticeships, mentoring, project banks, think tank competitions, summer schools, etc.); acknowledging the role of industry partners as educational, research and employment partners, and ensuring their engagement in the full student’s learning experience, including strategy development; creating effective learning ecosystems that engage all key stakeholder groups, including education & training providers, industry, policy-makers, supporting structures and broader community.



What works

Several examples of collaboration with industry were shared among EU and ASEAN partners to circumvent and conceptualise collaboration models.

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UBIC 3: Work integrated learning

Curriculum design: Launch the university's policy. All curriculums at PSU are designed based on outcome-based education approach.

Cooperative study: Students work in the industry for one semester in a specified job position.

Co-designed and co-teaching subject: PSU and CPF Company

Learning from the industry

Key activities were identified accordingly.



Cooperative study: 3 key activities

- Training the students before starting the cooperative study.
- Training the teachers how to be a good coach for student's project.
- Extending the collaboration with the industries - MOUs between university and companies.

As such, many good practices were identified before classification for sharing:

| | |
|---|--|
| <p>T1a: Industrial partners implication in the programmes design</p> | <p><i>o To include professional representatives in advisory committees</i> <i>o To regularly review and update programmes with professional representatives</i></p> |
| <p>T1b: Industrial partners participating in the programme operation</p> | <p><i>o To include industry representatives on examination boards</i> <i>o Industrials who teach, supervise student projects, cooperative and problem-based learning</i></p> |



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| | |
|--|---|
| T2: Professional work activities integrated in the curriculum | <ul style="list-style-type: none"> o WIL/WBL/internships/apprenticeships o To elaborate learning activities that reproduce real life experiences, PjBL with industrial partners o To enable the development of practical skills enhancing employability o To coach students on individual orientation |
| T3: Graduate Employment & Employability Analysis | <ul style="list-style-type: none"> o To periodically conduct surveys on employment&employability of graduate student o To survey and analyse the development of the job market and the employment of engineers o To analyze insertion disparities according to specialties |
| T4: Students Preparation for Employment & Careers in STEM education | <ul style="list-style-type: none"> o Career centers o To promote career guidance in career centers o to integrate career orientation courses o To value the creation of professional businesses by the engineering students |
| T5: Financial models, financial sustainability for or with UBC in education | <ul style="list-style-type: none"> o <i>To collect external financial support & resources</i> o <i>To foster scholarship from industrial parts</i> o <i>To receive support for STEM teaching equipment from companies and alumni</i> |
| Dedicated Physical learning areas for UBC (formal or unformal workplaces). | <ul style="list-style-type: none"> o <i>To increase/enrich learning infrastructure and facilities</i> o <i>To obtain support for improving education facilities</i> o <i>To create a real-life learning environment from companies for students</i> o <i>To receive support from companies that experiential and creative learning spaces for students</i> |
| R&D linkage with industries in STEM education | <ul style="list-style-type: none"> o <i>To develop research Platform for university-industry</i> o <i>To call the companies setting up R&D center in University</i> o <i>To integrate industrial environment and startup ecosystem into the campus, and bring students into the incubation</i> o <i>To collaborate with the industrial partners on human resource capacity building and on innovative startup development</i> |
| Faculty Competence Development with Companies | <ul style="list-style-type: none"> o <i>To increase the support of companies in developing STEM teaching capacity;</i> o <i>To improve lecturer/teacher capacity in learning approaches and methods, in delivering Student-Centered-Learning approach;</i> |

Echoes to curriculum design and renewal were specifically addressed all along the project lifetime.



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Curriculum design

Outcome-based education

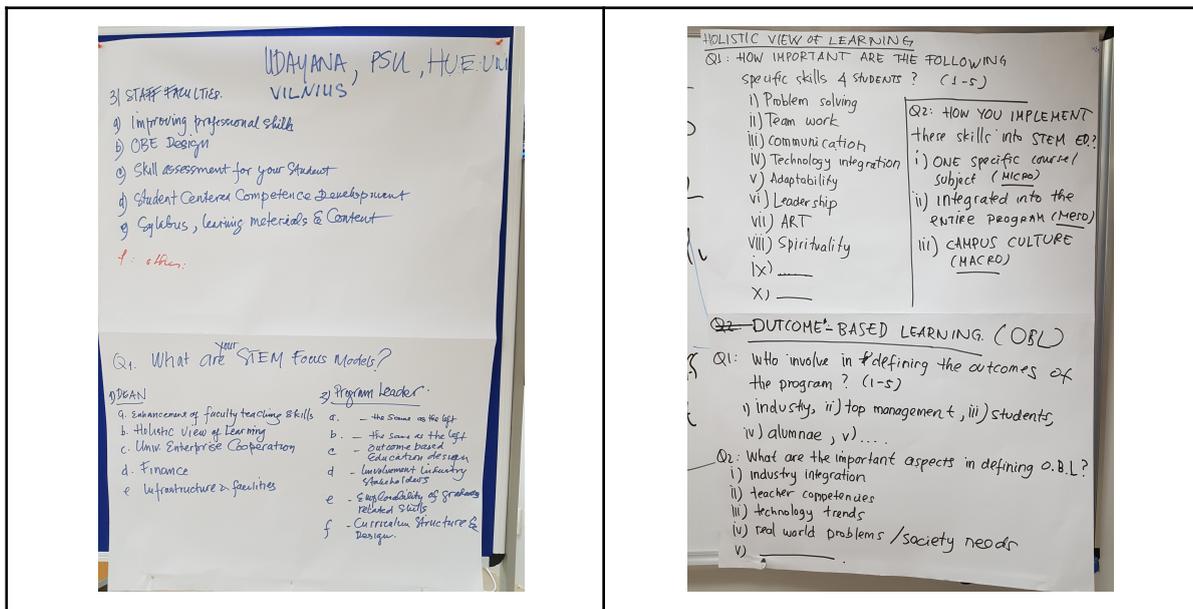
Stakeholders' needs as input for developing program learning outcomes.

Program coordinators need to get the information from the industry.

Survey, interview, focus group.

Priorities and resistance factors

Priorities and concerns for STEM education were listed from the early beginning of the project.



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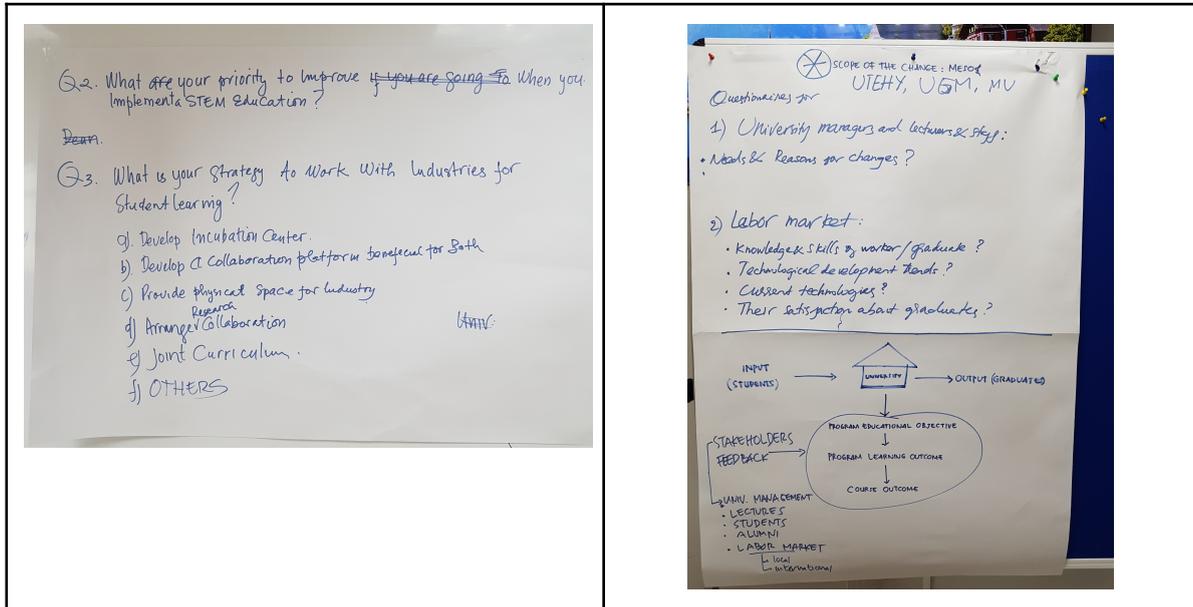
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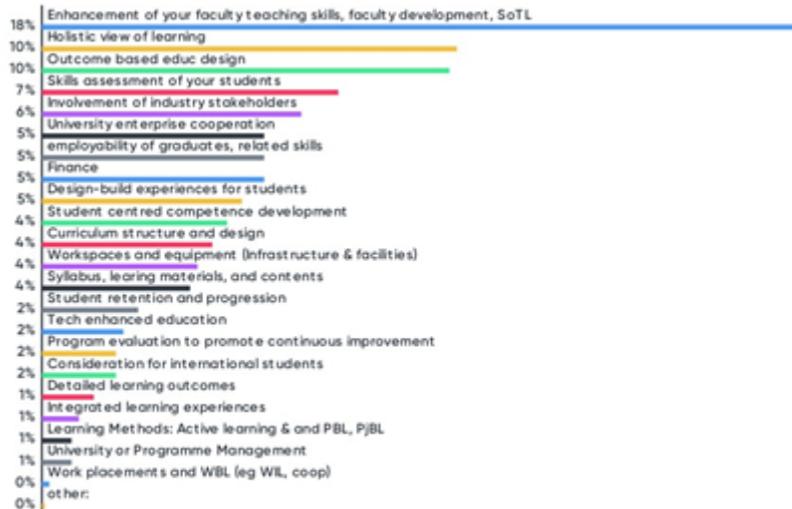


For Questionnaires in the theme of university-industry cooperation, 4 missions (inspired by French CTI criteria) were proposed for STEM Faculty/Schools to be reinforced in priority within the 3-5 years, 38 new missions were collected thanks to your responses. Around 50 strengths and 40 weaknesses were collected on the themes. They will be used to identify new themes or sub-themes and to extend/refine the Content Analysis of (1) and its conceptual map. Most of the programmes under focus are at BSc levels, in 4 years. The number of freshmen enrolled each year range from 20 to 250 students. Two programmes in Thailand are at MSc level, with 5 to 10 students enrolled each year (in 2 years after a BSc degree). One partner in Indonesia also targets three VET programmes, in 3 or 4 years, with approximately 60 students enrolled per year in each. Overall, 17399 students enrolled are in the scope of EASTEM WP4 impacts in the 10 ASEAN partners.



Prioritize these issues

Mentimeter



6

Accordingly, what motives change in STEM curricula, as drivers, were shared thanks to questionnaires:

- What do you think is really important in a STEM curriculum?
- What curriculum changes for STEM education have you seen to increase the quality of your students capabilities?
- Who are the current leaders in STEM education in your country?
- Who are the current leaders in STEM education in your institution?
- Who are the facilitators of best practices in your institution for STEM education?
- Who do you think will be the emerging leaders in 5y time for STEM education in your country?
- Who will define best practice in 5y time for STEM education in your country?
- Do you follow an accreditation model, which ? (nat QA model, ilt model)?
- Which are your Good Practices of programmes in STEM education
- What specific needs and purposes are motivating you (or have motivated you) to make changes in your STEM programs?
- What are your current needs for educational changes in STEM?
- What are your current drivers for educational changes in STEM?
- What are the Resistance factors or actual barriers of programmes renewal in your STEM education?
- On what could you expect to inspire other EASTEM partners?
- industry links in relation with job market & employability within STEM partner programmes?
- Corporate partner involvement (interns, projects?), Industry direct involvement ? eg WIL or apprenticeships



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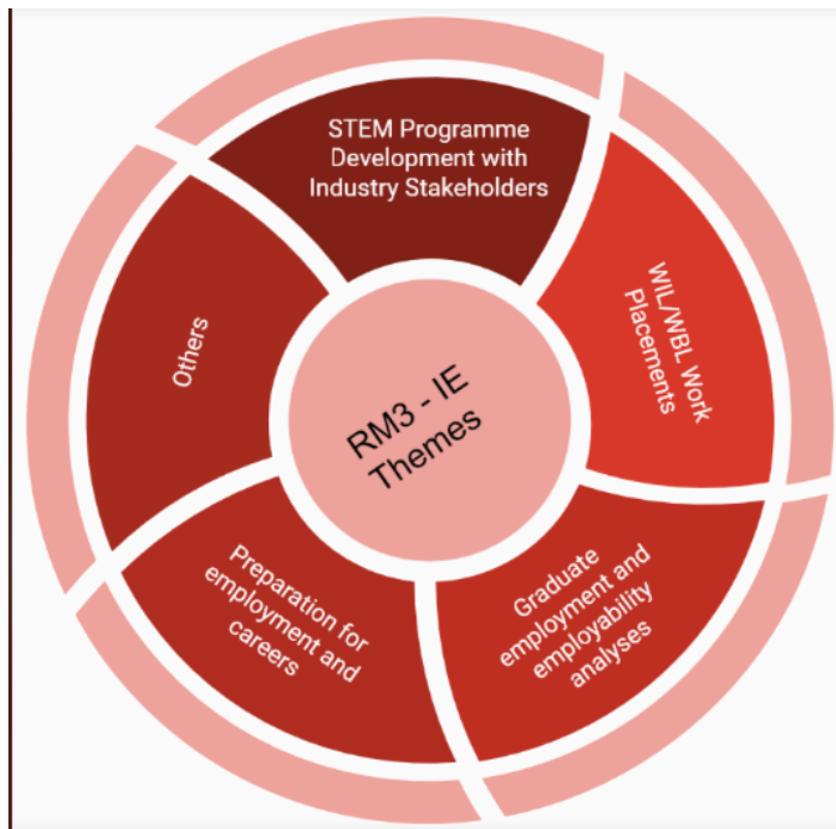


Webinar "Student-Centered Learning in Internet-Based (Online) Teaching"
By Euro-Asia Collaboration for Enhancing STEM Education (EASTEM) THAILAND



Sharing strategies for overcoming obstacles

- Due to the ongoing difficulties as a result of COVID-19, we probably will still use Zoom and LINE as the main communication format.
- Key person of each major project have been assigned to lead the task, but everyone will contribute accordingly.
- For sustainability, we will apply for more funding to continue our work either from the government funding agencies, the industry partners, or from the university.





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University-Business collaboration formats

Aside from indicative educational frameworks for internal quality enhancement, more prescriptive accreditation systems include standards and criteria for external evaluation and labelling.

French engineering education themes

As a Quality Assurance (QA) organisation, the *Commission des Titres d'Ingénieur* (CTI) was established under French law in 1934, with strong industrial link requirements. CTI's board membership comprises 50% of employers and professional engineers' representatives. In France, an engineering graduate school must establish partnerships with counterpart institutions and its stakeholders, particularly employers, industries and communities. The CTI references and guidelines serve for periodic assessment and accreditation, as authorisation to grant the Award of *ingénieur diplômé*. The latest English version (CTI, 2017) is used hereafter to identify the formal UBIC requirements, with verbatim text in quotation marks:

- A formal UBIC requirement to integrate industrial partners in programme design and operation: in the standard B on external links and partnerships, CTI strongly recommends that 'the engineering programmes have established lasting and mutually beneficial relationships with industry. Active professionals are involved in the school's bodies as well as in the design and implementation of programmes' (CTI, 2017). In the standard C on design and follow-up of the training project, CTI also recommends that 'the school has advisory committees comprising professional representatives and alumni; students may participate. For each programme, the committees provide advice for follow-up and update the curriculum' (C2), and 'there is a clear formal process for the design and approval of new engineering programmes. The programmes are regularly reviewed and updated to assess their relevance (C2.3)' (CTI, 2017). 'Significant training time is provided by professionals from the corporate world (e.g. guest lectures) in the University workspaces for theory/practice balance' (C5.2), with a quantitative minimum percentage required. Active professionals are involved in the implementation of programmes (CTI, 2017), a quantitative threshold is fixed;
- A formal UBIC requirement to facilitate Work Placement of students during the curriculum: in the standard C on industry and research internships, CTI requests that 'curriculum include learning experiences which enable the development of practical skills to enhance graduate employability and strengthen the links with industry, [...] programmes [...] should comprise a significant amount of industrial experience throughout the curriculum, mainly in the form of internships in industry' (CTI, 2017). Learning experiences that contribute to practical training are to include:

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- Internships in industry: a compulsory integrated internship period for all programmes and students of 28 weeks minimum, with ECTS credits;
- Learning activities that reproduce real-life experiences (projects with industrial partners directly involved, simulations and industry games);
- Industry visits, and seminars organised by industry representatives (CTI, 2017);
- A formal UBIC requirement to analyse graduate employment & employability: in the standard E on graduate employment, CTI strongly recommends that ‘the school has an organised approach to surveying and analysing the development of the job market and the employment of engineers’ (CTI, 2017). For employment and employability analysis at programme level, ‘Surveys are periodically conducted to collect and analyse information on the employment and careers of engineers in general, and more specifically on the employability of degree programme graduates (time to first job, level of wages, area of activity, etc.)’ (CTI, 2017);
- A formal UBIC requirement to prepare students for employment & careers: in the standard E2, CTI recalls that ‘the school promotes career guidance and job preparation for future graduates. It values the creation of professional businesses by the engineering students and supports them’ (CTI, 2017). In Criteria C5.2, individual orientation activities and coaching is provided by professionals.

European level themes for accreditation

From 2012 to 2015, the European Ministers of the European Higher Education Area gave as a priority for working to improve employability, learning throughout life, the ability to problem solving, entrepreneurial skills, through enhanced cooperation with employers, especially for the development of training programmes. This formal recommendation applies to all Higher Educational Institutions (HEI) and fields and it has a special resonance for the training of STEM learners in universities. To contribute to the common understanding of QA for learning and teaching across European borders, the Standards and Guidelines for QA of the European Higher Education Area (ESG) were set in 2012. Accordingly, as an instance, the French *Haut Conseil de l'évaluation de la recherche et de l'enseignement supérieur* (Hcéres) set criteria for research-led universities, including their educational programmes and research labs. But the ESG criteria are less complete than for accredited engineering programmes much more industry-oriented, as with CTI in France. In another European country, the Swedish QA system is not strictly aligned with the ESG. The Swedish Higher Education Authority (UKÄ, 2020) proposed an assessment area on Working Life and Collaboration, but with one criterion only, at programme level for engineering. The area is more a recommendation than indicated formal requirements, as written in the assessment procedure: ‘The HEI has well-functioning collaborations with the labour market and with the surrounding society that help improve the courses and programmes. Working life and collaboration are systematically factored in as part of the HEI’s quality system and quality work. Using information produced within the quality system, the HEI identifies needs for

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development of working life and collaboration elements in its education. The HEI implements measures and improves the programmes to ensure they are useful, and continuously develops students' preparedness to face working life. The HEI has systematic procedures and processes for ensuring that planned measures or implemented measures are appropriately communicated to relevant stakeholders, both internal and external' (UKÄ 2020).

On a pan-European level, the European Network for Accreditation of Engineering Education (ENAE) aims at building a framework, in order to enhance the quality of engineering graduates and to facilitate the mobility of professional engineers in Europe. ENAE evaluates the policies and procedures implemented by accreditation and QA agencies which have applied for authorisation to award the EUR-ACE® label to the engineering degree programmes which these agencies accredit (e.g. CTI). In collaboration with industry, accreditation agencies should confirm to ENAE that their HEIs (verbatim):

- Achieve the programme aims, which must reflect the needs of employers and other stakeholders (ENAE, 2015, sec. 2.4.1). The aims should take into account employment opportunities for graduates and the needs of employers. For such, are the relevant industry and labour market organisations and other stakeholders consulted? Is the methodology and schedule of consultation adequate in order to identify educational needs? Have the stakeholders' educational needs identified in a way which facilitates the definition of the programme aims and programme outcomes. Are these aims and outcomes described in terms of professional competence profiles and functions/roles/activities expected?
- Provide a teaching and learning process that enables students to demonstrate achievement of Programme Outcomes; if the programme includes time spent in industry, it should be assessed in the context of its contribution to the achievement of the Programme Outcomes (ENAE, 2015, sec. 2.4.2). Thus, are the partnerships with public and/or private bodies for training periods outside the university adequate, quantitatively and qualitatively, to the achievement of the programme outcomes?
- Comply with internal QA procedures. Processes of engineering graduate placement monitoring are in place. Thus, do the results of the monitoring of the engineering graduates' job placement and of the employed graduates' and employers' opinions on the graduates' education provide evidence of the qualification's value, of the appropriateness of the programme aims and the programme outcomes to the educational needs of the labour market? (ENAE, 2015, non-prescriptive Appendices sec. 5.5);
- Provide adequate resources. Assistance with external placements should be readily accessible by students (ENAE, 2015, sec. 2.4.3). Thus, does the programme provide student support services (career advice, tutoring and assistance) relevant to the learning process and enable students' learning and progression easier?



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In suggestive frameworks for STEM education (e.g. CDIO optional standard suggestions and Curriculum Guidelines 4.0), UBIC common themes are thus including Partnerships and Industry Engagement in designing and operating curricula, Workplace and Work-based learning. The QAEMP project added Links to Employability. For prescriptive accreditation standards and criteria (e.g. French CTI, ESG, UKÄ, ENAEE), UBIC themes differ, and sometimes also include employment analysis (e.g. tracer study) and career preparation courses. UBIC recommendations or formal requirements are at different levels. They could be partially required (P), largely required (L), fully required (F), or even not required (N) when no elements are explicitly provided (cf. NPLF scale of ISO33020).

UBIC Asean criteria

Most universities in Thailand are members of the Council of University Presidents of Thailand (CUPT), and they tend to apply CUPT for quality assurance. CUPT QA at programme level adopted the ASEAN University Network – Quality Assurance, as in Vietnam and Indonesia. The eleven criteria developed in the third version of the AUN-QA model for programme level (Pham et al. 2020) will be studied further in the EASTEM project, as it was done with ENAEE standards for regional levels. As an example, AUN-QA criterion 2 recommends that programme learning outcomes are formulated based on stakeholders' needs. The industry and business partners are the main stakeholders. Out of the scope of this paper, two other national ASEAN Higher Education Quality Standards which include some UBIC assessment areas are under review as well (i.e. Vietnamese Bộ Giáo dục và Đào tạo criteria and Indonesian BAN-PT with its recent flexibility to learn outside the study programme called Kampus Merdeka).

In Thailand, the Thai government provides funding for the public universities to develop degree and non-degree programmes that can produce the graduates equipped with professional competency i.e. STEM skills as well as 21st-century skills. This is to prepare a high quality workforce that can serve industrial needs for Thailand 4.0 policies. The regulation is ensured by Thailand's Office of the Higher Education Commission (OHEC, 2014) and the Office for National Education Standards and Quality Assessment (ONESQA, 2018). ONESQA has broad scope and does not provide strategic plans for the industry linkage, being at institution level, it does not provide UBIC details at the programme level. For work-integrated learning is the policy at the Ministry and university levels.

In Thailand, there is an UBIC linkage in terms of curriculum development, credited and uncredited internships, and learning activities. The industry provides feedback as stakeholders and evaluates the university graduates whether they are well equipped with both hard and soft skills for the jobs in their sectors. Thai government has launched many programs to involve the industry aiming for enhancing students' learning experience. For instance, the Thailand Science Research & Innovation have launched the Industrial & Research Projects for Undergraduate Students programme, which provides funds for

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undergraduates to work and help solve industry-based problems in Thai factories/industries. The learning activities echoing UBIC mostly involve project-based learning in the fourth year of undergraduates in order to complete science and engineering degree requirements. Furthermore, a 'Talent mobility' program was established to assist both undergraduates, and postgraduates to conduct research on industry-based and problem-based learning by providing financial support and also matching demands and interests between university researchers and the industry.

In Thailand, some industries and university alumni also participate to host undergraduates during their third year of the degree programme to work as apprentices for 2–3 months. The internships can also be credited to some degree programmes, according to each curriculum regulation and requirement fixed by the university. Furthermore, some programmes offer cooperative education, where students can be trained in the industries as staff for at least one semester. Each student is supervised by both a mentor from the company and a teacher at home university.

UBIC practices

Participation of industrials in the field of education 4

In each school:

- Programme Council (UBIC 1)
- Courses (UBIC 2)
- Internships, Apprenticeships (UBIC 3)
- Preparation for a professional career (UBIC 5)
- Industry linked FabLab like AirbusLab at IMT Atlantique (UBIC 8)

At IMT general management level:

- The Trades and Skills Observatory of IMT (UBIC 4)
- IMT Disrupt'Campus: An accompanying program to digital transformation, for students and companies (UBIC 7)
- The IMT Foundation (UBIC 6)
- German-French Academy for the Industry of the Future (UBIC 7)

Initiated by the French partner, myriads of activities to support industry collaborations were listed and shared among ASEAN partners. Among others:

- Educational goals:

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- To strengthen and expand networks with industrial partners in order to accommodate cooperative learning
- To cultivate partnerships between the university and industrial partners in order to facilitate innovation-oriented learning in the STEM-targeted curricula
- To work together to reskill and upskill the workers (workforce) to work in a modern operations process (with advanced technologies)
- To increase cooperation with companies in developing workforce training programs in STEM field
- To equip graduates with problem solving and critical thinking competencies
- To increase science components in the curriculum
- To provide a seamless forum to introduce (undergraduate) students to real-world user environment and needs through closer interactions with industry
- To bring graduates relevant to user needs as a driver for research and education
- To bring the curriculum closer to social need
- Faculty development
 - To increase the support of companies in developing STEM teaching capacity for teachers
 - To improve lecturer/teacher capacity in learning approaches and methods
 - To increase the lecturer capacity in delivering SCL approach
- Programme design:
 - To integrate industrial partners in the program design and operation
 - To integrate Industrial partners in the program design & operation
 - To integrate Industrial partners in the programmes design & operation
 - To gather feedback for improving the curriculum
 - To implement outcome-based education connected to real-world problems
- Course operation:
 - To integrate collaborative course based on industrial need
 - To integrate short courses for industrial parts
- Innovation and R&D
 - To develop research Platform for university-industry
 - To call the companies setting up the R&D center in University
 - To integrate the industrial, startup, and entrepreneurship environment and development (develop an industrial environment and startup ecosystem into the campus, and bring students into the incubation)
 - To collaborate with the industrial partners on human resource capacity building and on innovative startup development
- Employability
 - To empower graduates to enter workforce
 - To empower students to enter the workforce



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- To increase the graduate employability in regional (ASEAN) and international market
- To prepare students for Employment & careers
- To analyse Graduate Employment & Employability
- Financial aspects
 - To collect external financial support
 - To collect the external financial resources
 - To obtain financial support from industrial partners for STEM activities
 - To foster scholarship from industrial parts
 - To receive support for STEM teaching equipment from companies and alumni
- Workspaces
 - To increase/enrich learning infrastructure and facilities
 - To obtain support for improving education facilities
 - To create a real-life learning environment from companies for students
 - To receive support from companies that experiential and creative learning spaces for students.



- **UBIC-1:** Industrial and Business partner's implication in STEM programme design, review & revision;
- **UBIC-2:** Industrial and Business partner's participation in STEM programme teaching & learning activities;
- **UBIC-3:** Professional work activities integrated in STEM curricula;
- **UBIC-4:** Graduate Employment & Employability Analysis at STEM Schools;
- **UBIC-5:** Students Preparation for Employment & Careers in STEM programme.

UBIC 1



BCT Program design
With experts from
the industries.

UBIC 2



Students visited manufacturing plants
To learn about bioprocessing from
Industry professionals.

UBIC 3



Students, in collaboration with a local
business, made an air purifier and donated
to non-profit organizations.

UBIC 4



Staff Meeting on
Graduate Employment &
Employability Analysis

UBIC 5



Senior-year student
training on digital literacy

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THE JOBS, TRADES & SKILLS OBSERVATORY OF IMT (UBIC 4): an interaction & exchange space to develop a systemic and prospective vision on skills, trades, jobs and training

Surveys and annual barometers on the evolution of digital and industrial jobs



- Recruitment trends since 2009
- #100 companies interviewed each year
- 15 industrial and digital sectors

Annual survey on the integration of young graduates

Foresight, studies and white papers



"In-company training: a survey of the challenges to be met".
 → Make all training operators aware of the **transformations** underway in the training sector

Projects:

« Osons l'industrie du futur» (Dare the industry of the future) – 1,8M€

- + 150 Interviews
- Detailed analysis of the skills identified to build or update training courses
- 6 sector studies, 18 jobs and skills descriptions

- Maintenance,
- Management,
- Big Data,
- Production,
- Supply Chain,
- Research and design



- Communication among young people and employees to attract them to the industry of the future (MOOC, Forums, Website,...)

New diplomas:

- **Engineer by apprenticeship**, specialising in the digital transformation of industrial systems (IMT Atlantique)
- **Bachelor of Technology** – Manager of the digital transition in industry (Saint Etienne)
- **Bachelor of Technology** - Additive and innovative manufacturing process (Saint Dié-des-Vosges)

A concept map of more than 80 good practices was drafted before categorization:

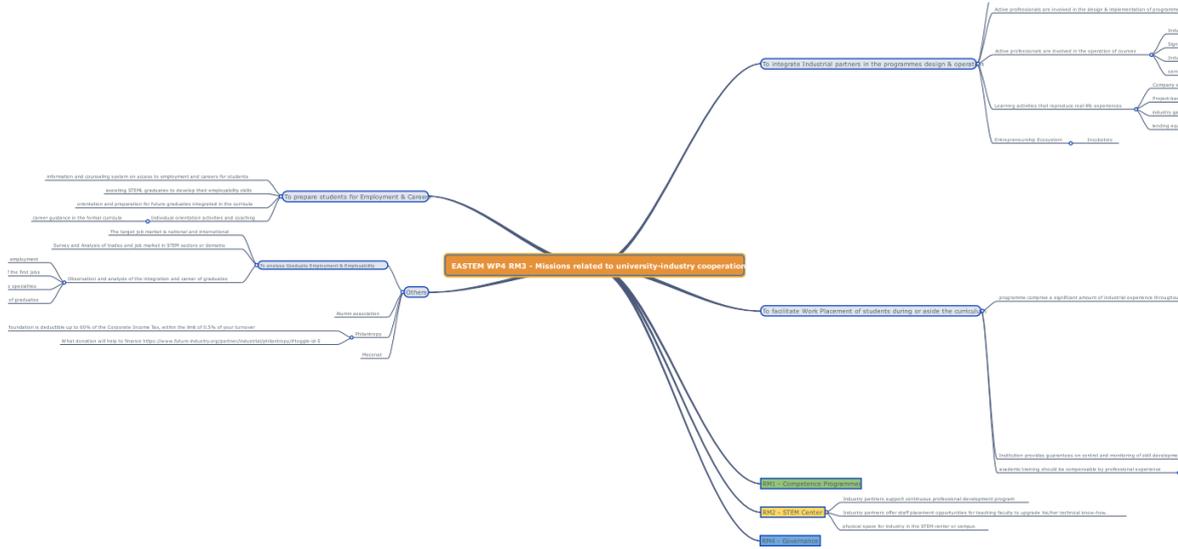


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UBIC categorization

A mapping of themes to structure and exemplify UBIC models for Continuous Improvement of STEM Higher Education and Engineering Education, by columns of reference sources, was proposed, with its NPLF subjectivity as written requirements in the literature are sometimes ambiguous and interpretative and may not reflect reality. It consists of the following selected themes, by lines, resulting from the previous section analysis:

- **UBIC-1:** Industrial and Business partner’s implication in STEM programme design, review & revision;
- **UBIC-2:** Industrial and Business partner’s participation in STEM programme teaching & learning activities;
- **UBIC-3:** Professional work activities integrated in STEM curricula;
- **UBIC-4:** Graduate Employment & Employability Analysis at STEM Schools;
- **UBIC-5:** Students Preparation for Employment & Careers in STEM programme.

Table. Tentative Mapping of UBIC Themes in some Frameworks Applicable to STEM Education, NPLF requirements according to ISO33020 scale.

| NPLF req. scale | CDIO (Rouvrais & al 2017) | CDIO (Cheah & Leong 2018) | QAEMP (Bennedsen & al 2018) | Guidelines 4.0 (PwC 2020) | France (CTI 2017) | Sweden (UKÄ 2020) | EU (ENAE 2015) | Thailand (ONESQA 2011) |
|-----------------|---------------------------|---------------------------|-----------------------------|---------------------------|-------------------|-------------------|----------------|------------------------|
| UBIC-1 | L | L | L | N | F | P | F | L |

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| | | | | | | | | |
|--------|---|---|---|---|---|---|---|---|
| UBIC-2 | L | N | N | L | F | N | N | P |
| UBIC-3 | L | L | L | L | F | N | L | L |
| UBIC-4 | N | N | N | N | F | P | F | L |
| UBIC-5 | N | N | L | N | L | N | L | N |

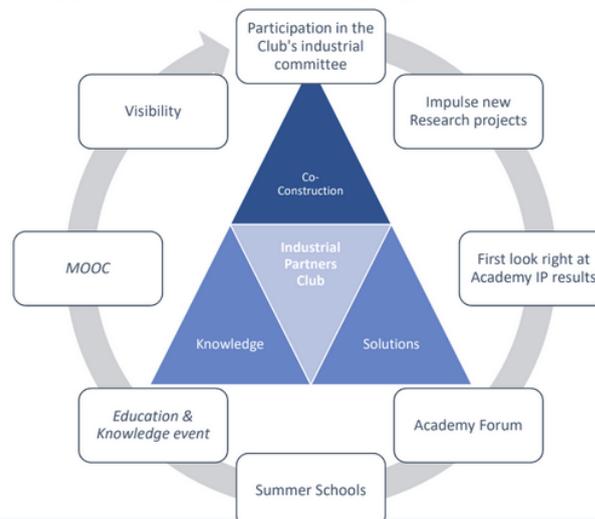
Three additional UBIC themes were put to the light by partners with the following potential missions:

- **UBIC-6:** Financial aspects with Industry (strategic QA): public funds are under pressure and external sources will permit to better prepare high quality workforce to serve industrial needs for ASEAN 4.0 policies: to collect external financial support & resources, to obtain financial support from industrial partners for STEM activities, to foster scholarship from industrial sectors, and to receive support for STEM teaching tools from companies and alumni are keys;



Philantropy – Founding members program of the Industrial Partners Club

A unique value proposition:
Discover and access an
ecosystem and academic
resources



- **UBIC-7:** Innovation and R&D with Industry (functional QA): a few years ago, some analysis of research development & technology (based on paper publications and patents) in Thailand and south-east Asia (except Singapore) reflected that the research does not strongly contribute to industry development in the country: to develop research platform for university industry, to attract the companies setting up R&D centres in University, to integrate industrial environment and startup ecosystem into the campus, and bring students into the incubation, and to collaborate with the industrial partners on human resource capacity building and on innovative startup



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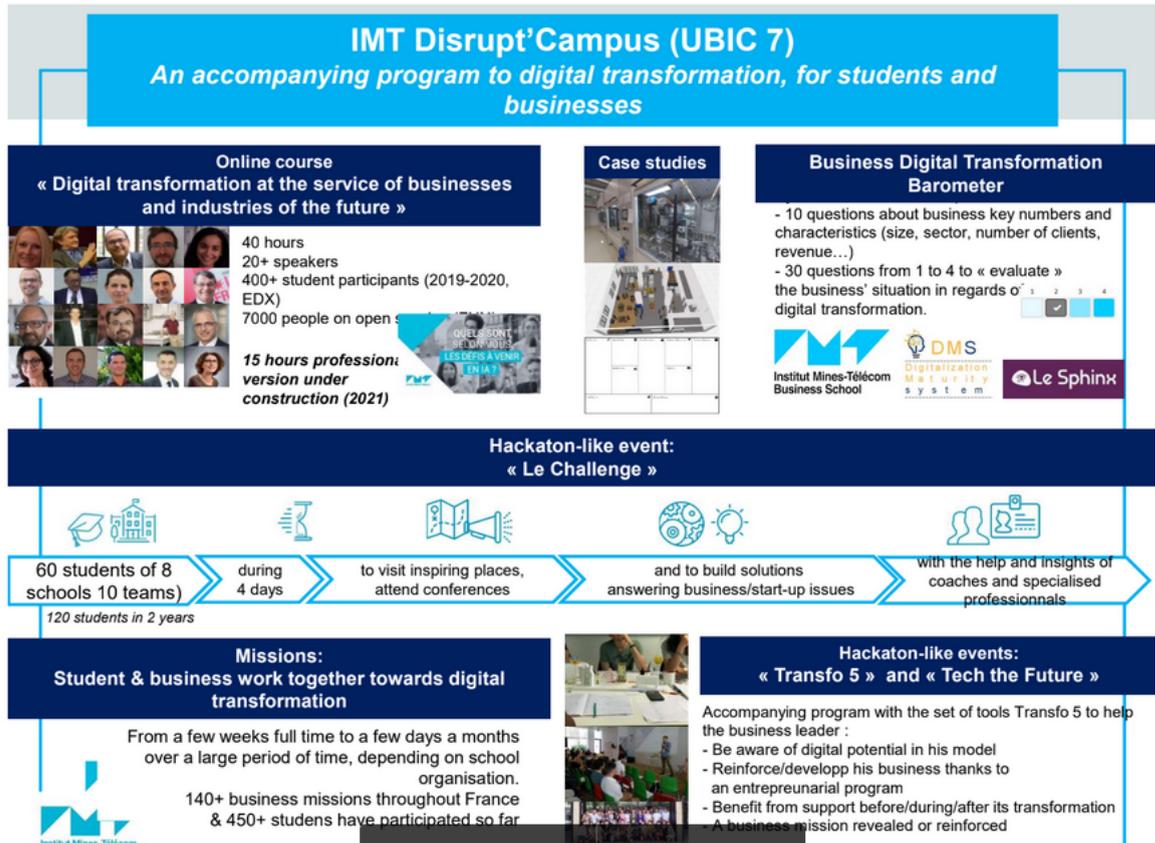


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development are keys;



- **UBIC-8:** Workspaces with Industry (echoing CDIO standard 6): to increase/enrich learning infrastructure and facilities, to obtain support for improving education facilities, to create a real-life learning environment from companies for students, and to receive support from companies that experiential and creative learning spaces for students are keys.

As a discussion, for some UBIC criteria, indicators and thresholds for achieving the so-called excellence are different. Even if incorporating involvement of academic staff, students, and other stakeholders is classical in periodic STEM programme design & revision in most universities, the profound implication of industrial partners can be rather partial (P), quantitatively in the process and decision committees for UBIC-1. For example, Thai QA has reflected industrial and business partners' implication in programme design & revision for curriculum development that has to be done in every five years with comments and feedback from industries as one of the stakeholders. To report annually if most Thai public institutions send questionnaires to industries which are employers of some of their graduates to meet ONESQA Criterion 2 (indicators on employability in one year after graduation and employer satisfaction), the formal requirements remain rather partial (P) or empty (N) on other UBIC themes, quantitatively and qualitatively. In fact, the quality of research is the main concern.

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In Thailand, universities also provide cooperative learning which is a collaboration between academic and industry partners (UBIC-3), most curricula accredit vocational training of third-year students. The industry partners take part in mentoring on special projects for fourth-year students. As another example, the formal level of requirements for work placements by French CTI during the curriculum is high (F), with a minimum of 28 weeks (internship compulsory and ECTS credited for all students), including mature processes in place at institution level.

With industrial partners from France (e.g. Amadeus/Bookbeo/Nokia/Orness/Thales), many good practices were shared, validated and categorised in Padlets (<https://padlet.com/siegfriedrouvrais/f4eey2y2vrn64a0s>, pwd: UBIC):

Industry 'dating'



08.50 Coffee and Tea break

09.00 -11.00 **WP4 – WP4 Paralel – Collaboration Practices on targeted UBIC themes, to learn & inspire via 'Industry dating'**

Format: 4 break-out rooms for exchanging on various UBICs in 3 rounds.

Task: Identify sharable good practices for university-industry collaboration.

Team moderators / rapporteurs (GDocs): N. Chelin (IMT Atl.), G. Jacovetti (IMT Atl.), S. Rouvrais (IMT Atl.), J. Reardon (JUJ), <https://padlet.com/siegfriedrouvrais/124v24rikuph7f3f> (password: UBIC)

| | Team A | Team B | Team C | Team D |
|-------------------------------------|-------------------------------|------------------------------|----------------------|----------------------|
| Moderator | G. Jacovetti (IMT Atl.) | S. Rouvrais (IMT Atl.) | N. Chelin (IMT Atl.) | J. Reardon (JUJ) |
| IMT member | G. Landrac (IMT) | P-G. Meunier (IMT) | M. Assar (IMT) | J. Belage (IMT) |
| Round-1: 9.00-9.40 | UBICs 1&2 Amadeus, Nokia | UBICs 3&8 Thales | UBICs 4&5 Orness | UBICs 6&7 Bookbeo |
| Round-2: 9.45-10.15 | UBICs 3&8 Bookbeo & Orness | UBICs 4&5 Amadeus | UBICs 6&7 Nokia | UBICs 1&2 Thales |
| 10.15 – 10.30: Coffee and Tea break | | | | |
| Round-3: 10.30-11.00 | UBICs 4&5 Nokia | UBICs 6&7 Thales & Orness | UBICs 3&2 Bookbeo | UBICs 3&8 Amadeus |



An 'industry dating' took place, with 4 parallel rooms and 3 rounds for exchanging on various UBICs. 'Industry partners met were:

- **AMADEUS** (<http://amadeus.com>) - IT Group
 - Mrs Najeth Geuffroy, campus manager
 - Mrs Clemence Molies, recrutement manager
- **BOOKBEO** (<https://www.bookbeo.com/en>) – Augmented reality expert (start-up)
 - Mrs Sophie Deniel, Founder
 - Mr Sullivan Gauville, R&D manager and Alumni
- **NOKIA** (<https://www.nokia.com/>) – Data center network and telecom
 - Mrs Clemence Molies, University relation manager
 - Mrs Jelena Pesic, R&D manager and Alumni
- **ORNESS** (<https://www.orness.com/>) – Information technology consulting
 - Mrs Carole Amado, Founder
- **THALES Group** (<https://www.thalesgroup.com/en>) – Aeronautic and Defense
 - Mrs Myriam Chevreuil, Head of Recruitment and University relation manager



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EASTEM October meeting UBIC starter
UBIC Moods prior to EASTEM WP4 October meeting

- UBIC-1 Design**: President Macron meeting w industry? What is that?
- UBIC-2 Courses**: Challenge IMT Disrupt: courses with Airbus, Dassault, BNP Paribas, Sopra, Bouygues Telecom
- UBIC-3 WIL**: Return of experience on teaching by industry professionals - Sébastien Bolelli of Ormess
- UBIC-4 Employment Analysis**: Employment with Machine Learning by Nokia
- UBIC-5 Career Prep**: UU podcast about career opps for chemistry graduates
- UBIC-6 Finance**: Impact of giving
- UBIC-7 Innovation**: Entrepreneur
- UBIC-8 Workspaces**: The "garage" by Nokia

And some themes were accordingly investigated to prepare of Body of Knowledge on some practice in Padlets (<https://padlet.com/siegfriedrouvais/124v24rzkuoh7f3f>, pwd: UBIC):

EASTEM October meeting Team's follow-up
UBIC Moods during EASTEM WP4 October meeting

- Team A around UBIC 2 with ITDel, HUS & UGM**: On Tuesday with Gilles
- Team B around UBIC 3 with CMU & UTEHY (& UNUD)**: On Tuesday with Jake
- Team C around UBIC 3 with PSU & ITB**: On Tuesday with Siegfried
- Team D around UBIC 5 with HCMUTE, MUSC & VU**: On Tuesday with Nathalie
- Various / Dazibao**: IMT Barometers 2021

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EASTEM project report, deliverable D4, February 2022



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Chapter 2: Competence Integration Needs

This chapter provides collaborative insights on reforms or STEM program redesign rationales, recommendations on processes. Specific, detailed learning outcomes for personal and interpersonal skills, and professional skills, as well as disciplinary knowledge were identified consistent with programme goals and are validated by programme stakeholders.

| Scale | Criteria |
|-------|---|
| 5 | Evaluation groups regularly review and revise program learning outcomes, based on changes in stakeholder needs. |
| 4 | Program learning outcomes are aligned with institutional vision and mission, and levels of proficiency are set for each outcome. |
| 3 | Program learning outcomes are validated with key program stakeholders, including faculty, students, alumni, and industry representatives. |
| 2 | A plan to incorporate explicit statements of program learning outcomes is established. |
| 1 | The need to create or modify program learning outcomes is recognized and such a process has been initiated. |
| 0 | There are no explicit program learning outcomes that cover knowledge, personal and interpersonal skills, and product, process and system building skills. |



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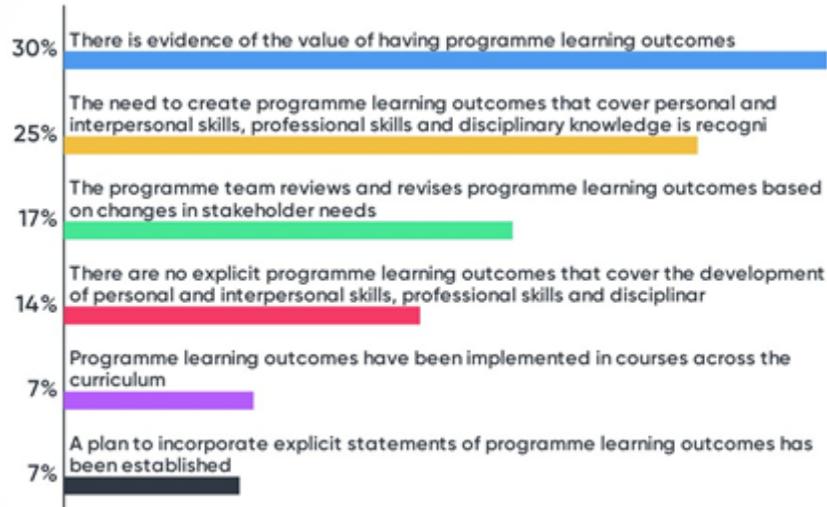
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Prioritize these issues

Mentimeter



8

Elements of actions that enhance faculty disciplinary competence, professional and teaching skills were undertaken, e.g. design and deliver engaging learning experiences and assess student performance. This ensures subject relevancy is maintained and that teaching practices promote learning and a positive student experience.

| Level | Description |
|-------|---|
| 5 | Faculty competence in disciplinary knowledge and teaching practice is regularly evaluated and updated where appropriate |
| 4 | There is evidence of the value of faculty development in terms of disciplinary knowledge and teaching practice |
| 3 | Faculty members engage in faculty development opportunities in accordance with the plan |
| 2 | There is a systematic plan for faculty development in terms of disciplinary knowledge and teaching practice |
| 1 | The need to develop faculty competence in terms of disciplinary knowledge and teaching practice has been recognised |
| 0 | There are no programmes or practices to enhance faculty competence in terms of disciplinary |

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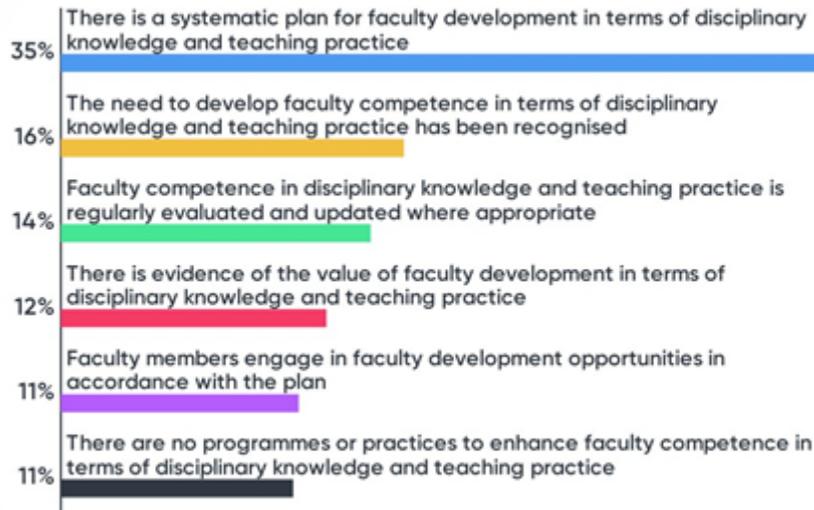
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Prioritize these issues

Mentimeter



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Accreditation and Quality Assurance

Increasingly, more and more criteria on HE programs are offered in quality procedures, sometimes even imposed on training directors by accreditation agencies. The level of training quality requirements, as well as their maturity, often vary from one country, one culture, or one type of institution, to another.

The COVID-19 pandemic significantly impacted higher education as a whole, and the various educational institutions, along with policies and plans from government bodies. The accreditation references of programmes came under the spotlight, with the requirement to ensure that the curricula became more agile and open.

The project partners are drivers for change in educational approaches in their local and national context. Still the majority of teaching is based on traditional methods rather than meeting today's needs of the students. This is in spite of government efforts. For example, in Vietnam the Ministry of Education and Training has identified STEM education as a key factor for development. In Indonesia, all of the higher education curriculum must refer to Kerangka Kualifikasi Nasional Indonesia (Indonesia National Qualification Framework), focusing in part on competence development. As part of the Thailand 4.0 Policy of the Thai government and the strategy of the Ministry of Education, Thailand is hoping to develop a

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holistic strategy to prepare teachers and school leaders to deliver education reform,
with a strong emphasis on improving teachers' skills.



With the focus on improving the quality of higher education and enhancing its relevance for the labour market and society, EASTEM objectives are also in line with the new EU Skills Agenda, more specifically increasing STEM graduates and fostering entrepreneurial and transversal skills. Lecturers from our three European partners gain additional insight and perspective on SCL teaching approaches and industry engagement and establish new partnerships with colleagues in Asia. Through the STEM centres, partner universities have strengthened relationships with industry partners and high schools. For example, when launching a STEM centre in November 2019, Mahidol University (Thailand) signed a memorandum of understanding with Imagineering Education Company. Partners in Vietnam and Thailand emphasize the potential for their STEM centres to establish cooperation between academia and industry. Partners in Thailand have also pointed out that the EASTEM Training of Trainers courses help improve the quality of education, with the potential to transform teaching and learning philosophy and inspire lifelong learning. Vietnam's government recognizes STEM education as a driving factor for a strong labour workforce that meets the requirements of the 4th Industrial Revolution. For example, in Thua Thien-Hue province, EASTEM's activities connecting universities with high schools and industry partners are also in line with the province's ambition to develop a smart city urban cluster.

Example of Merdeka Campus in Indonesia

The Independent Learning Policy - Merdeka Campus (MBKM) is a program launched by the Indonesian Ministry of Education, Research and Technology, to prepare students to face changes in social, cultural, world of work and rapid technological advances, student competencies must be prepared to be more responsive to the needs of the era. Link and match not only with the world of industry and the world of work but also with a rapidly changing future.



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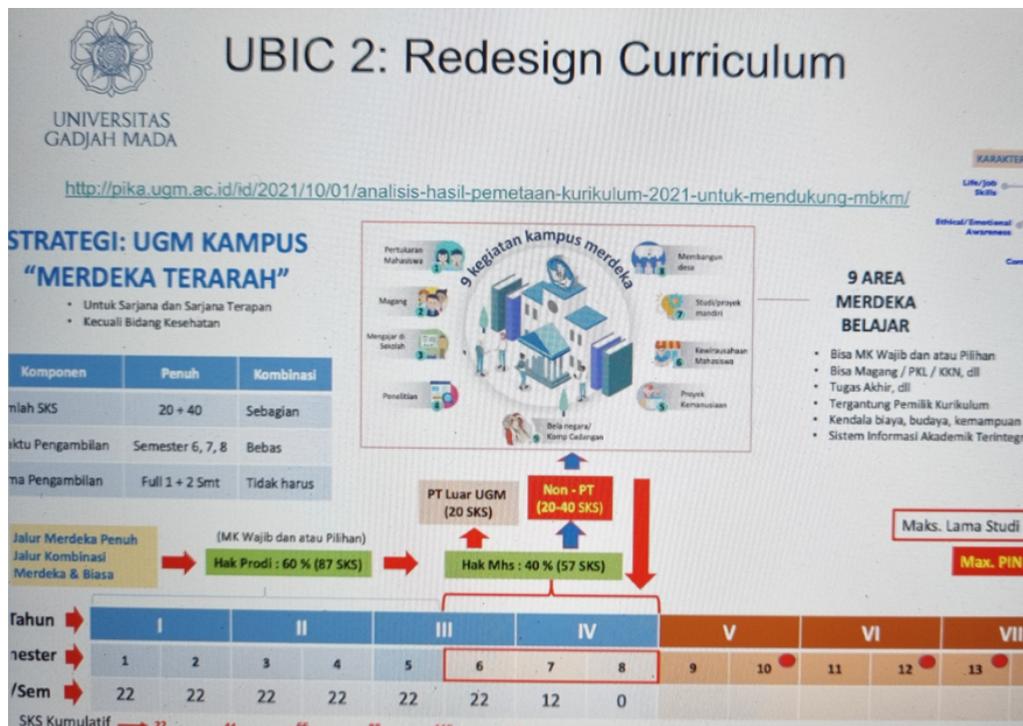
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| Indonesian Accreditation Criteria | Excellent Score |
|--|--|
| Collaboration in Education | #International, National, Regional, Local |
| Collaboration in Research | #International, National, Regional, Local |
| Collaboration in Community Services | International, National, Regional, Local |
| Outcomes of collaboration with industry, scored by 3 aspects : (1) benefit to the study program for T3D (teaching, research, community dev)(2) improve the performance of T3D and facilities(3) customer satisfaction and sustainability of the collaboration | Valid proof of the outcomes |
| Lecturers from Industry/Practitioners | (Diploma/Vocational Program Only) |
| Graduate GPA | GPA >= 3.25 of 4.00 |
| Average Length of Study (LoS) | A: 3,5 < LoS <= 4,5 (4 years program); V:3 <= LoS <=3,5 (3 years program) |
| Academic and Non-academic students achievement (publication, research with his/her prof, arts, sports or others) | intrntstionsl, national, regional, local |
| Length of study | A: 50% on time; V: 70% |
| Successful Rate (low~0 drop out) | >85% |
| Tracer Study is scored 5 aspects: (a)university level, (b)regular and yearly, (c)completeness of questionnaire, (d) sample: 3 years populations (e) theresult of tracer study is used as curriculum, teaching&learning improvement. | 5 aspects are satisfied |
| Waiting time for the first job | A: < 6 months ; V: < 3 month |
| Suitability of Graduate job position | >60% |

Universities are required to be able to design and implement innovative learning processes so that students can achieve learning outcomes covering aspects of attitudes, knowledge, and skills optimally and always relevant.



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Challenges and change needs for transformation process

In light of the global fourth industrial revolution era, high quality STEM education is seen as a critical success factor for ASEAN countries economic growth. In that context, the EASTEM (Euro-Asia Collaboration for Enhancing STEM Education 2019-22) capacity-building project, aims at improving employability of STEM graduates from ten partner universities by ensuring students acquire skills needed in the workplace. With the knowledge exchanged through the EASTEM partnership, each partner's expertise and experience synergistically enrich each other, and will in turn subsequently benefit all partners. This includes developing strategies for enhancing their own STEM education system, to establish a platform for networking on STEM education, and to safeguard the pitfalls of education in rapid changes of science and technology.

In EASTEM, most of the STEM programmes under focus are at BSc levels, in 4 years. In that context, methods and tools are already developed for fostering competence integration in STEM programmes and for establishing STEM centres at partner universities. Overall, 17,399 students enrolled are in the scope of EASTEM impacts in ASEAN partners in the short term.

As challenges e.g. in Thailand, since degree programs and curricula have been designed to include industries and communities as stakeholders to meet UBIC1&2 by having feedback and evaluation from industries and also the sharing experiences from professionals in industries in courses of our curricula. Training in industry by undergraduate students ranging from weeks to months can be counted as credits. For instance, CMU undergraduate students can choose to spend 3 weeks in industry, this can be transferred to 3 credits of Training subject in BSc. Microbiology program. CMU also deliver the Co-operative Education: Co-op for student to spend a semester in industries. The next challenges that can be carried out:

1. We would like to promote more industry visits and also seminars organized by industry representatives. During COVID 19 crisis, this has allowed us to have all students and staffs in both academia and industries are more equipped and acquaintance with the digital platform for seminars and meetings without extra cost of travel. However, visits on sites are also of importance. We plan to increase both seminars in digital platform and also industry physical visits in years to come. This will provide more opportunities and hours of contacts of students to be able to learn and have experiences in real life scenarios.
2. We would like to promote the research activities in universities to serve industrial problems (real world problems) and the industrial partners can take part as a co-advisor/mentor in the thesis or special projects of students both undergraduate

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and postgraduate level. This will create win-win situation and sustainable & mutual relationships between university and industries/communities.

3. We will encourage staffs in industries to upskills their current knowledge by taking course or degree (postgraduate degrees, or diploma) to transfer knowledge and skills between universities and industries.
4. CMU promotes CMU alumni, graduates to comeback to join academic activities and to obtain credits that may be able to part of their skills development. Such program will help the CMU graduates to be able to maintain their updated knowledge and skills required by their working places. CMU has set up a life-long learning center to function on this.
5. Teaching and Learning Innovation center and College of Arts, Media and Technology that partake in simulations and industry games. CMU will promote more of these activities.

For an other Thai partner, UBIC-5 Students Preparation for Employment & Careers in STEM programs was focused regarding to student preparation for employment and careers implemented in Faculty of Science,

1. B.Sc. courses that encourage employment preparation
 - a. Internship for Innovation and Entrepreneurship. Principles and process of field study and field professional practicum on management of public R&D organizations and private enterprises; invention and quality product development; innovation management of community enterprise and community business; entrepreneurship effect on community, economic and public society; evaluation; hold a seminar to report the results of internship program.
 - b. Internship for Innovation and Entrepreneurship. Field professional practicum in R&D and innovation development in public organizations and private enterprises; management and implementation of raw materials; used technology; production line; quality control; product distribution; marketing; logistics and supply chain of the enterprise and related business.
 - c. Strategic Management of Innovation. Strategic management of innovation; types of innovation and patterns of change in technology and market; SWOT and PEST analysis; creating and implementing a product development strategy; design thinking; managing the new product development process and teams; strategic control and corporate governance; management of intellectual property.
 - d. Internship in Industrial Mathematics. Internship in the factory under guidance of the advisors.
2. Course collaboration with industries. Creating courses to have opportunity to meet incubator or successful startup such as SPACE-F – global FoodTech startup incubator and accelerator in Thailand. This course should allow students to learn

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success stories, meet entrepreneur, and new startup incubator. The course will
create links between industrial and students.

Also in Thailand, to improve UBIC3 Professional work and activities of students. Was
considered:

1. To discuss with the University's top management about the policy to support students
professional works at the industries.
2. To make collaborations with the industries. University's representatives may visit
more companies to get more companies that are willing to participate in students'
training and cooperative studies.
3. To set up a system that supports companies and students. Students can work in the
position (task) that they wish to train. Companies can get qualified students to fit the
positions/jobs.
4. To promote the training programs and cooperative studies to students to increase the
number of participants.
5. To train our teachers to understand about the training program and cooperative
studies. The teachers can help students getting ready for training program. Teachers
can also support/supervise student's projects at the industries.

In Vietnam, in the current context, the link between universities and businesses is an
inevitable trend in the socio-economic development of all countries. The width and depth of
this link depends much on the orientation of the authorities, the choice of mode as well as
the compromise of the subjects. The effect of the connection is always to improve the
"stature", reinforce the trust as well as increase the level of positive influence on the social
life of the related parties. Shortening the distance from lecture halls to business practice is
an urgent requirement for tertiary training institutions and the business community. The
society is in urgent demand, the "barrier" is almost exclusively within the subject of the
subjective factors of the association. For WP4 plans were considered:

- Establish Industrial Advisory Board in every Faculty/Institute to enhance interactions
with Industrial partners (E.g.: Faculty of Information Technology is working with
Amazon Web Service; Faculty of Electrical and Electronic Engineering with Rockwell
Automation, Mitsubishi...; so on).
- Cooperating with Industrial companies to conduct more scientific contests for
students (UBIC-2)
- Increase more internships and company-on-site semesters in companies (UBIC-3)
- Increase more Industrial scholarships (UBIC-3 & UBIC-6)
- Sign MoU with GSS on STEM learning and equipment sponsorship enhancement for
Institute of Technical Education. (UBIC-8)
- Sign MOU with Microsoft Việt Nam to support for students FREE Office 365 and
other 4.0 technological platforms/applications (UBIC-8)

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- Further develop and enhance the existing cooperation plan with businesses including manufacturing facilities, research institutions; assigning specific personnel to be in charge of, monitoring the linkage of vocational education with enterprises and the labor market. The new trend in the demand for personnel of enterprises shall be updated in the data every 2 years and updates the content of the training program accordingly. Similarly, the new materials/technology being applied in the production which are reported by the factories or introduced at the exhibition/trading fair will be recorded and updated to the teachers and students.
- Standardize the contingent of managers and teachers, improve the efficiency of vocational training.
- Investing in facilities and equipment to meet the increasing requirements in the quality of vocational training as well as the requirements of enterprises for high-tech labor.
- Diversifying programs and forms of cooperation with businesses: Link training with businesses to organize the implementation of training programs; training according to the order of the business; cooperation in developing output standards, training programs and textbooks; cooperation in organizing and fostering teaching skills, organizational skills, training management skills for school teachers and technical staff (teachers) of enterprises participating in teaching; cooperation for students to study while working at vocational training institutions and enterprises; cooperating in training and retraining to improve skill levels and granting training certificates for enterprises' employees and recruiting people to enter apprenticeships and apprenticeships to work for enterprises. Actively participate in the relating Vocational Associations by attending workshops, events and exchange information.
- Set up a specialized department to link and cooperate with businesses.
- Build cooperation agreements with businesses
- Develop cooperation programs with businesses



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In Indonesia, most collaboration with partners are related with these following activities:

- Human Resource Development
- Supervision of Standard and Educational Quality Sharing knowledge or insights with lecturers and students (colloquia, lectures, and seminars)
- Joint Research Activities and publication
- Community service in tourism, health, agriculture, empowerment rural communities, information technology development, engineering management.

Accordingly, we are aware that we need to develop collaboration with industry related to their involvement in the teaching and learning program and activities. The selected recommendations to reinforce our collaboration with industries are:

- to invite alumnae to be:
 - guest speakers (like seminars) with topics relevant to our curriculum.
 - guest lecturers deliver materials in the regular formal academic class.
- to develop more collaboration with industry by inviting them to review our curriculum and in turn, we send our students to do long period internships in the industry.
- To collaborate with industries in diverse domains, where the industries provide our students with problem challenges, real world datasets, and computing facilities for their final projects or internships. Some examples of this collaboration are as follows.
 - BukaLapak, a prominent e-commerce provider in Indonesia.
 - Prosa, a startup company focusing on AI solutions
 - Agate, a leading game industry startup in Indonesia
- To proactively invite prominent speakers to give guest lectures in various domains and courses. More specifically, in the Computer Science study program, at least 15 guest lectures have been delivered last year.



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- To allow students to take some courses off-campus. Although these activities are currently not recognized in the curricula, they help our students to better understand the subjects. For example,
 - Program Bangkit by Google, which provides off-campus learning for around 300 students per university nationwide, covering diverse topics such as AI, software engineering, soft skills, etc.
 - Dicoding Academy, which provides software development courses in collaboration with various prominent software development platform providers, such as Microsoft, Google, and Amazon.
- To design and implement new courses, which can be used as container courses to recognize students activities in the industry, e.g., Industrial Informatics course.
- Nationwide, the Ministry of Education and Culture has launched a policy called “Kampus Merdeka” (Freedom Campus), which gives students opportunities to take diverse external activities to further enhance their understanding related to their major. By applying this policy, it will allow us to recognize up to 2 semesters of external activities as part of our curricula.
- To extend our collaboration with different partners, which will give more ways to further enrich our students' learning and experiences.

Accordingly, action plans for recommendation were:

- to conduct a meeting with Vice Rector, division of career centre and alumnae coordination affairs to sit for strategies and schemes of alumnae-teaching program.
- To conduct a meeting with Dean and Head of Study programs about the scheme and list out alumnae qualifications to be relevant with their curriculum.
- To publish the program to alumni. The program is targeted to be a regular annual collaboration with alumnae.
- To smooth recruitment process.
- To offer training, meeting with the selected alumnae.
- To prepare the next program that will be improved based on the evaluation.
- To conduct a meeting with Vice Rector-3 (who is handling collaboration affairs) to list down all industrial partners and select the potential ones after discussing with Head of Study Programs
- To develop the detail scheme together with Vice Rector-3 based on the regulation that has been issued by Minister of Education
- To develop communication with industries about the program and detail scheme
- To publish the scheme to students along with the list of partner industries,
- To formaoze the selection process by Head of Study Programs and the Industries
- To compile the tracer study to update the curriculum
- To make more MOU with industry



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Reform & redesign rationales

Curriculum agility is important when relevant professional disciplines are developing rapidly, as in engineering (Brink et al., 2020). Brink et al. (2020) in their research, developed a shared vision on curriculum agility, where an agile curriculum is responsive and adaptable to changes in society and business, as well as student characteristics and needs, by having the capacity to change structures, learning outcomes, and learning activities in a timely manner. They introduced seven pre-formulated principles of curriculum agility, which defines or refines the concept of curriculum agility. Agility is perhaps now more than ever an unavoidable property of curricula to meet the transformational challenges of educational programmes in a more continuous manner; due to the various crises impacting the HE sector (García-Morales, et al., 2021; Govindarajan & Srivastava, 2020; Mishra, et al., 2020).

Resiliency of the system and its key stakeholders is of the essence. The concept of resilience represents one of the four cross-cutting priority areas of Health 2020 and the SDGs². During a high-level meeting in Monaco in October 2016, Member States presented the first outcomes of their interest and commitment to the topic of resilience. According to IROWH (2016), the word “resilience” comes from the Latin verb “*risalire*”, which means to rise again (to bounce back). A resilient community is able to cope with change, and retain its structures and functions after disturbances in order to keep up with continuous development. There is also growing interest in system-level resilience within the 2030 Agenda for Sustainable Development³. Moreover, resilience can be developed over a lifetime (i.e. with a life-course approach), which is a pillar of the 2030 Agenda.

As a practical solution on curriculum agility and resilience, ASEAN EASTEM partners have strongly engaged in STEM curriculum change according to Industry collaborations via various models, in order e.g. to create student’s experiences in working with the industry via cooperative and problem-based learning, also to develop oth hard skills and 21st century soft skills for STEM university graduates. Several goals were addressed with action plans and operations during the COVID period.

² <https://www.un.org/sustainabledevelopment/>

³ <https://sdgs.un.org/2030agenda>

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UBIC-3: Professional work activities of students recognized in STEM curricula

- To create students' experiences in working with the industry via cooperative and problem-based learning
- To develop both hard skills and 21st-century soft skills for university graduates.

Program design & operation

- Industrial connections through CMU Science and Technology Park (CMU-STeP)
- Connections through CMU Alumni Association
- Connections through other stakeholders (e.g. employers of the CMU graduates)

Innovation-oriented learning/curricula

- Several STEM programs are in a process of revising their curricula to become outcome-based education (OBE), which can be innovation-oriented
- Industrial partners are willing to push and support innovation-based programs



Co-financial support

- Strong business partnership, e.g. with PTT Public Company Limited.
- Industrial Corporate Social Responsibility (CSR) programs
- CMU's e-Donation platform (automatic filing of 2x tax-deductible)

Cooperative learning

- University's reputation makes it attractive for future partnerships
- Feedbacks from past operations of coop learning programs
- Established industry-university network to guide professional education, problem-based learning, and academic activities.

HR capacity building & innovation incubation

- Industrial partners have been cooperative and feeling honored to help out
- Faculty members are enthusiastic to learn more on how to integrate innovation making in their pedagogy
- Both HR capacity building and startup development are two of the key missions of CMU STeP



Curriculum co-designs and redesigns experiences were shared.

Co-design



ผลการเรียนรู้ (Learning Outcomes)

| | | |
|--|--|--|
| <p>Aware of new technology used in the industry that is vital for businesses to remain competitive on a global level</p> | <p>Identify opportunities or gaps that will take businesses related food and agriculture to the next level</p> | <p>Apply the knowledge gained into a project selected/assigned by the university</p> |
|--|--|--|



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UNIVERSITAS GADJAH MADA

UBIC 2: Redesign Curriculum

<http://pika.ugm.ac.id/id/2021/10/01/analisis-hasil-pemetaan-kurikulum-2021-untuk-mendukung-mbkm/>



STRATEGI: UGM KAMPUS "MERDEKA TERARAH"

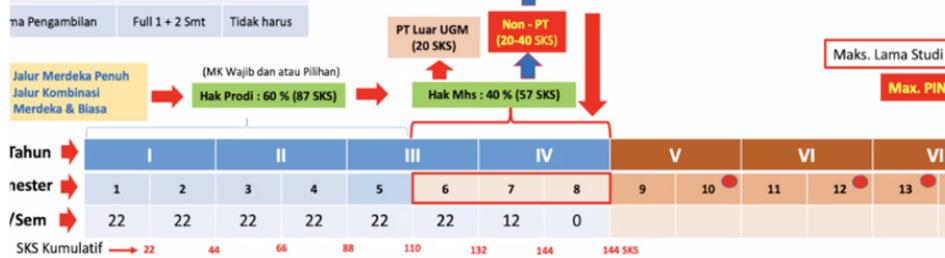
• Untuk Sarjana dan Sarjana Terapan
• Kecuali Bidang Kesehatan

| Komponen | Penuh | Kombinasi |
|-------------------|------------------|-------------|
| Waktu SSKS | 20 + 40 | Sebagian |
| Waktu Pengambilan | Semester 6, 7, 8 | Bebas |
| Waktu Pengambilan | Full 1 + 2 Smt | Tidak harus |



9 AREA MERDEKA BELAJAR

- Bisa MK Wajib dan atau Pilihan
- Bisa Magang / PKL / KKN, dll
- Tugas Akhir, dll
- Tergantung Pemilik Kurikulum
- Kendala biaya, budaya, kemampuan ak
- Sistem Informasi Akademik Terintegrasi



For Indonesia, UBIC-oriented curricula were strongly reinforced in accordance with the Merdeka Belajar Kampus Merdeka (MBKM Freedom of Learning model), involving more external lecturers, alumni and stakeholders from Industry.

Google Classroom

Agus Muliastara, S.Kom, M.Kom
Dosen Informatika, FMIPA Universitas Lidyana
Koordinator EASTEM Lidyana

Dipresentasikan dalam webinar KKN PPM Universitas Lidyana
"Pelatihan Media Daring dalam membantu Pembelajaran siswa Sekolah Dasar di Desa Malinggih Glayyar"

2 Agustus 2021 - via Zoom Meeting

PERUBAHAN VISI MISI DAN PENINJAUAN KURIKULUM MBKM PRODI TEKNIK INFORMATIKA UNDHIRA

Agus Muliastara, S.Kom, M.Kom
INFORMATIKA - FMIPA - UNIVERSITAS LIDYANA
Diampatkan pada Workshop "Perubahan Visi Misi dan Peninjauan Kurikulum MBKM Prodi Teknik Informatika UNDHIRA"
7 September 2021

PROGRAM STUDI TEKNIK INFORMATIKA - FAKULTAS TEKNIK, SAHIL DAN TEKNOLOGI - UNIVERSITAS DIYANA PURA

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Universitas Udayana WP4

WP4 Activities - 2021 September 7
 UBIC Curriculum - **MBKM (Merdeka Belajar Kampus Merdeka - The Freedom of Learning)**
 MBKM Curriculum for Informatics Department of Universitas Dhyana Pura - UNDHIRA
 MBKM Curriculum for Informatics Department of Universitas Udayana
 MBKM Curriculum for Pharmacy Department of Universitas Udayana

STRATEGY FOR MBKM

5-3 : 5 Semesters in Origin Campus
 6-2 : 6 Semesters in Origin Campus
 7-1 : 7 Semesters in Origin Campus
 8-0 : 8 Semesters in Origin Campus

Minimum 20 credits/semester

Internal Lecturer
 Eksternal Lecturer
 Alumni
 Stakeholder
 APTIKOM (computer science association)

PERUBAHAN VISI MISI DAN PENINJAUAN KURIKULUM MBKM PRODI TEKNIK INFORMATIKA UNDHIRA

Tabel 4.4 Jenis Mata Kuliah/Kegiatan Magang dan jumlah sks minimum untuk model pembelajaran Merdeka Belajar – Kampus Merdeka (MB-KM)

| Jenis Mata Kuliah / Kegiatan MB-KM Setara Mata Kuliah | SKS | | | |
|---|------------------|------------|-------------|------------|
| | Konvensional 8-0 | MB-KM 7:1 | MB-KM 6:2 | MB-KM 5:3 |
| Mata Kuliah Wajib dalam Prodi | 89 | 89 | 89 | 89 |
| Bentuk Kegiatan MB-KM ke-1 | | A/B/C (20) | A/B/C (20)* | A (20)* |
| Bentuk Kegiatan MB-KM ke-2 | | | B/C (20)* | B/C (20)* |
| Bentuk Kegiatan MB-KM ke-3 | | | | B/C (20)* |
| Mata Kuliah Pilihan dalam Prodi | 60 | 40 | 20 | - |
| Total SKS | 149 | 149 | 149 | 149 |

Keterangan:
 A: Kegiatan MB-KM pertukaran pelajar yaitu mengambil SKS Mata Kuliah di luar Prodi dalam PT
 B: Kegiatan MB-KM pertukaran pelajar yaitu mengambil SKS Mata Kuliah di luar PT
 C: Kegiatan MB-KM di luar PT selain kegiatan Pertukaran Pelajar
 *Urutan kegiatan MB-KM yang dipilih bisa diubah-ubah, kecuali jika ingin diambil di semester V kegiatan yang dipilih harus bentuk pertukaran pelajar (A/B)

Several activities took place at partner institutions which now promote greater graduates' success in securing good jobs, available opportunities for students to experience learning & working outside the campuses, lecturers' professional activities outside campuses, lecturers' contributions through producing applicable and relevant work to communities, collaborative and participative learning..

Institut Teknologi DEL (2)



EXAMPLES OF WP-4 ACTIVITIES

- Graduates' success in securing good jobs
- Available opportunities for students to experience learning and working outside of the campus
- Lecturers' professional activities outside of the campus
- Teaching-practitioners in campus

- Lecturers' contributions through producing applicable and relevant work to communities
- International collaboration between study program units and partners
- Collaborative and participative learning
- International standard study programs



- Inggriani and Arlinta joined the Climate Freasque (arranged by Siegfried) together with other EASTEM countries last month, as one optional approach to be implemented at WP4

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Structured, high quality, training program to produce high-calibre graduates for world-class technology companies have been designed and operated, as more collaborations with companies/institutions under Ministry's certified internship and training programs.



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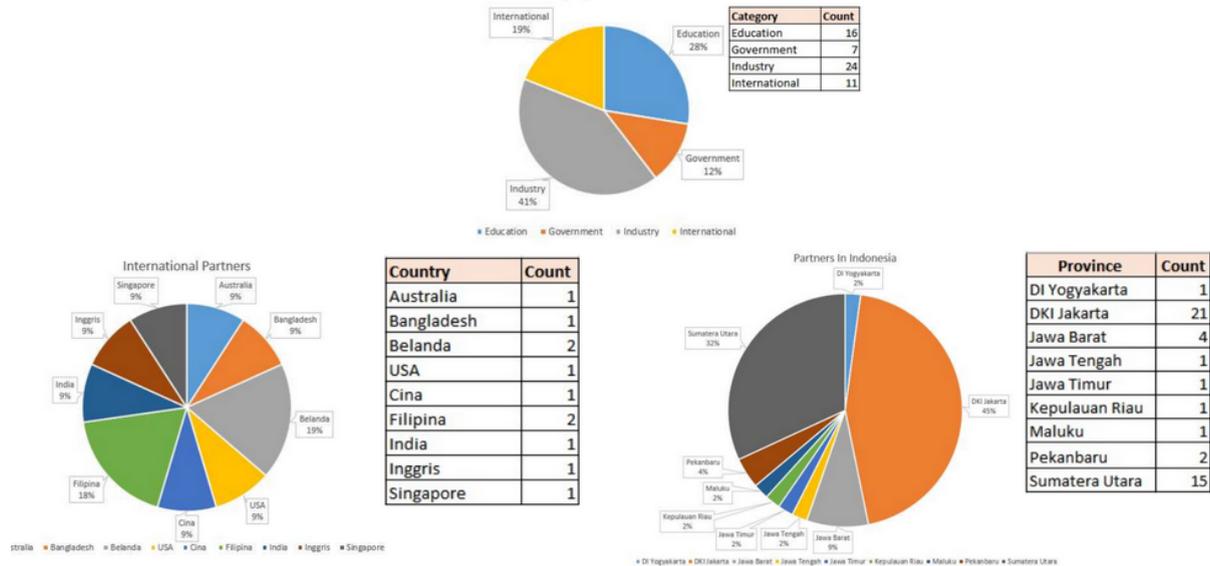


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Our Partners/Networking (ongoing)



In ITB, Freedom Campus Competitive Program (PKKM) was created, with a focus on Digital Innovation and Entrepreneurship: An ITB's initiative for sustainable efforts in strengthening the software industry ecosystem in the era of digital advancement through innovation and entrepreneurship. It supported strong collaborations with digital industries. Also, new Study Program Classes in Jatinangor Campus were implemented to Encourage multidisciplinary collaborations among students in Informatics, Information System & Technologies, Visual Communication Design, and Entrepreneurship study programs, with invited industries to provide real-world experiences for students. Also, international Virtual Courses (IVC) were created, incl. 37 Summer Courses Program designed for serving worldwide students and professionals to study (virtually) in ITB Campus.

In Vietnam, processes of competence integration took care of:

- Invite alumnae give a speech in first day of school ceremony/a school-year ending ceremony.
- Collaborate with industry & alumnae to review curriculum
- Cooperation in developing output standards, training programs;
- MOU with industry for internships, eg
 - HCL Vietnam Company Limited (IT)
 - Canon (Electronics)
 - Ford (Automotive)
 - Mitsubishi (Automation)
 - Towada (Electronics)

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- MOU with National Economics University



HUS-WP4 part 2 Processes for competence integration



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| WP4 | Date | Main aim and short description of the activities | Target group |
|--|---------------|---|---|
| Integrate industry requirements and student-centered teaching approaches into educational programmes | | | |
| Sharing research result for Quang Nam province | April-2021 | Making a collaboration in research; Agreement for students HUSC to learn practice from companies in the province | Teaching staffs; Researcher |
| Signing agreement with TMA Solution company | December 2020 | Research cooperation; Developing human resource; Student Recruitment (from HUSC) | Teaching staff Researcher Student |
| Signing MOU with Apply Science Institute – Van Lang University | January 2021 | Cooperation in research and technical transfer; Student exchange | Researcher; Student |

as

- creating On-site company semester with businesses. However, due to the prolonged and unstable Covid-19 epidemic, it was not possible to send students to businesses.
- series of activities to sign cooperation and agreements with businesses to support training.
- maintain the operation of the Career Center to support connection with businesses to improve the employment rate for students.



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All along the EASTEM WP4 activities, future plans were also considered to go ahead on current and new Industrial collaborations.



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Chapter 3: UBIC Models for Competence Integration

This chapter provides partner institutions with the capacity to develop their own processes for continuous integration of competence development aspects into educational programs.

As presented in an EASTEM video (<https://youtu.be/IMbM6E23fJA>), the framework is systemic, with many causal links, which require choices, strategic and logistical balances, and therefore collegial decisions which cannot satisfy all the stakeholders. industry-university collaboration modes address the following themes:

- Industrial partners in the design, evaluation and review of programs;
- Participation of industrial partners in training activities;
- Professional activities of students integrated into the programs;
- Analyzes of the employment and employability of graduates;
- Preparations of students for employment and careers;
- Financial aspects with industry;
- Innovation and R&D with Industry (incubators, industrial chairs, etc.);
- Training spaces with industry to create synergies.



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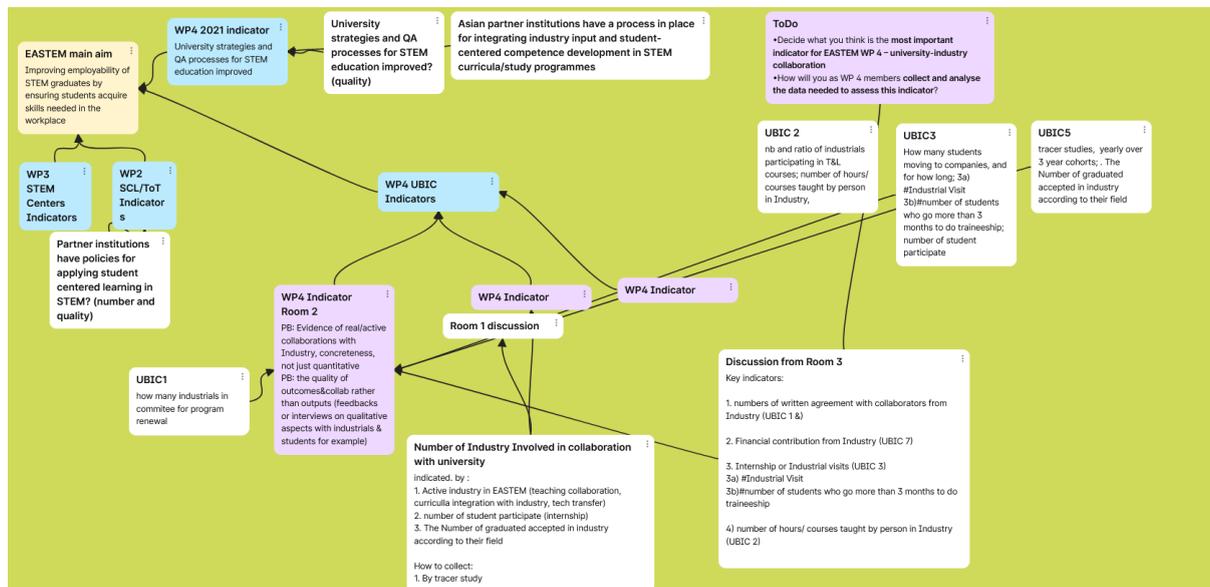
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Rationale, Success & Resistance factors

EASTEM partner universities have enthusiasm to establish or reinforce UBIC themes in their STEM education so as to better serve the industry and community needs. Nevertheless, the integrated approach and its ecosystem for local impacts have yet to be created and promoted among students, faculty staff, and communities. As such, indicators were shared:



To broaden the perspective of the UBIC mapping, a qualitative analysis had been run with university partners from two different European (France and Sweden) and the three ASEAN countries. In the first phase, partners were asked what could be the new missions for their STEM Faculty/Schools or the ones to be reinforced within the 3–5 years.



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| | UBIC-2 | UBIC-3 | UBIC-5 |
|---------------------|--|---|--|
| Quantitative | <ul style="list-style-type: none"> Nb and %ratio of industrials participating in T&L courses of the syllabus Nb of hours/courses taught by persons in Industry | <ul style="list-style-type: none"> Nb of students having moved to companies during the curriculum, incl. duration in nb of weeks Nb of industry visits per students | <ul style="list-style-type: none"> Criteria of tracer studies (e.g. 1 to 3 years alumni employment rates, salaries, job positions, waiting time for 1st job) Nb of graduates employed in industry according to their field (suitability) |
| Qualitative | <p>It was recognized that qualitative indicators are less easy to formalize, they could rely on satisfaction questionnaires sent to stakeholders (e.g. students, employers, HR) and on maturity levels of processes in place for some UBICs. To be investigated in forthcoming virtual meetings.</p> | | |



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| Challenges that we encounter with this UBIC and how to overcome them | | | |
|--|---|---|---|
| <p>IT Del: We are in rural area, it was hard to invite industries to come to give regular lecturers to our campus. Industries tend to harvest our alumni but not keen to contribute to our learning process ; Campus teach conceptual and generic knowledges and technology but the industry used the latest technology and tools. Industry has confidential "things/jobs", campus is an open space for IT related study programs, related to software development, it is easier. It is difficult for other study programs that need "hardw are" and real equipment (UBIC8). For hardware related topics, it is better to send the students to industry.</p> <p>UGM: Integration into Curriculums (the right workload) Finding the "right" topics for teaching and learning that beneficial for both University and Industry Finding the right supervisor both in industry and university Curse of Dimensionality: UGM is big University (50.000 students)- so each semester we need to find place (match) for students to the right companies, with the right level of need and knowledge</p> <p>HUS: The form of specialised programme between the university and industrial partner in teaching activities: joint process in CD and teaching → regulations</p> | <p>UBIC1: To design curriculums with industry partners which are suitable for industry needs especially professional skills. (CMU) -> Identify skills needed for graduates and design curriculum with stakeholders.</p> <p>Co-supervision of students for WILL program between Academic Institutions and Industries (CMU) -> Concrete benefits for industries to take parts such as supporting from government.</p> <p>UBIC1: To invite stakeholders (student, alumni, business, industry, leader, manager...) to develop curricula (UTEHY)</p> <p>Work based learning (UTEHY)</p> <p>to Design Curriculum that involves industries partner/practitioners in student's achieving learning outcomes → Merdeka Belajar Kampus Merdeka Programme in Indonesia (UNUD)</p> | <p>Assessment from industrial partners requires standardization</p> <p>Flexibility for students to work or to study</p> <p>Different workplaces: (1) there are different levels of work volume, (2) various levels of alignment with learning outcomes</p> <p>How to increase the number of students joining Cooperative study: To solve this problem: Analyze the problems (e.g. financial, far from industrial areas), what are reasons? find the solution (eg providing scholarship)</p> <p>How to increase the number of industrial partners: criteria for selecting good partners?</p> | <p>Morell paper Table:</p>  |

The five UBIC themes presented earlier were recognised as missions to be reinforced in priority by most of the partners.



| Ideas for first steps to take at home to strengthen this UBIC | | | |
|---|--|---|---|
| <p>Win-w in collaboration</p> <p>Authority (MoEs/MOETs): regulate and legitimate the "specialised programme"</p> <p>Compagnies : Hackaton, sponsored immersive games and cups ; small project to be done by students</p> <p>Students : getting experience from industry by long period internship (this is facilitated by our MoE).</p> | <p>Activities constructed to promote professional learning (UTEHY)</p> <p>Design/Improve curriculums (Multidisciplinary/Interdisciplinary) which provide students with knowledge and professional skills needed to work in industries (CMU)</p> <p>UBIC8: Provide more Co-working space for industries inside the campus, especially for teaching and learning, sharing and training students in professional work. (CMU) ->So ubic 8 could be seen as a prerequisite of ubic3 ! (IMT)</p> <p>Design/improve curriculums which let students to choose what and where they want to learn in industry based on the internship program in one semester, make MOU with industries to accommodate the needs (internship programme)</p> | <p>To make students, universities, and industrial partners understand and agree on learning outcomes of the internship</p> <p>To have intensive discussion with industrial partners</p> <p>To develop more systematic program or a model for internship program</p> <p>To strengthen collaboration between university and industry</p> <p>To discuss among teachers/tutors and advisors from the industries during the internship program</p> | <p>Student skill development (management, knowledge implementation, customer focused idea, team oriented skills)</p> <p>Industrial survey</p> |

Based on questionnaires operated in the fall 2019 and ongoing semi-structured interviews, additional themes and good practices of UBIC models were then identified. Thirty-eight new missions were collected and used to identify new themes or subthemes. Around 50 strengths and 40 weaknesses were collected on the UBIC themes. The philosophical stance was interpretivist, to prevent personal bias from influencing, as we emphasise the meanings University STEM programme leaders and deans confer upon their own institutional contexts.



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PUT OUR HEART INTO FOOD

CPF X PSU วิทยาลัยพัฒนาหลักสูตร
หลักสูตร Young Agribusiness Entrepreneurs
CPF Training Center

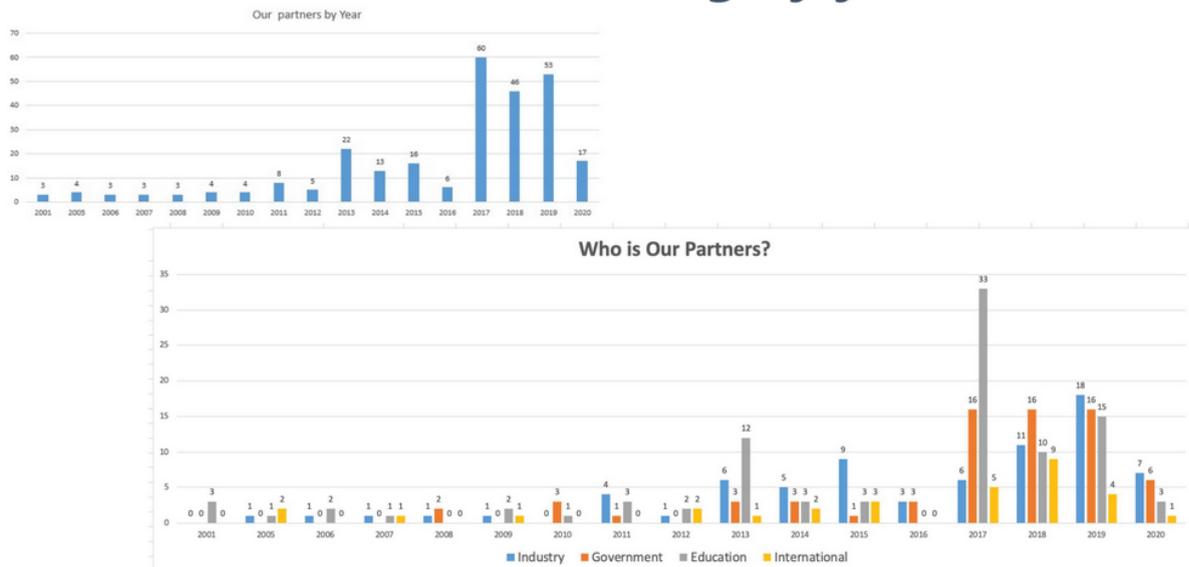
(Rationales)

With the digital transformation, all professions are changing completely. This includes agriculture, one of the oldest sectors in the labor market. Thus, how PSU in collaboration with CPF can prepare younger people return to agriculture as a promising profession.

The solution lies within the concept of agribusiness that encompassing farming as well as farming-related commercial activities. *“Young Agribusiness Entrepreneurs”* program, hence, is established to equip PSU students with knowledge, skills, and hands-on experiences from production to processing to the distribution.

The qualitative analysis opens up new prospects, e.g. the need to investigate further on guiding partners on how to integrate competence development for students into STEM education programmes and university strategies by engaging with deans, vice-rectors and rectors. With the knowledge to be exchanged and capitalised in the next phase via focus groups and workshops with high-level University representatives, ASEAN partner institutions acquired better capacity to develop their own processes for continuous integration of competence development aspects into their educational programmes and university strategies and policies, including the 5 + 3 UBIC themes identified and reinforce their strategic industry collaboration modes.

Our Partners/Networking by year



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Monitoring and Evaluation

Requirement and maturity levels in UBIC models differ greatly between the countries and institutions (e.g. prescriptive with quantitative minimums, quality assured formal processes to be in place) and are part of the international diversity, culture, educational and industry history, and national economic growth.



aka SMART
simplicity, convenience,
accessibility & affordability

Quantitative indicators: 0-5 QE maturities +

- nb of educational programmes/courses/students targeted and nb of impacted;
- nb of Industry integration into university education design, development & operation;
- number of industry representatives engaged;
- training module to improve the employability of graduate,
- Employability within 6 months / unemployment rates of STEM students,

Qualitative indicators:

- increased focus on professional competencies required by industry in educational programmes/courses;
- Student & Industry perception of competences;

In the EASTEM project, good practices are already identified and categorised according to UBIC themes, with collaborative support from university management of the EASTEM partners. One objective is that STEM programmes will be more sustainable and partner institutions better equipped to interact with corporate partners in the development of their STEM-university education.



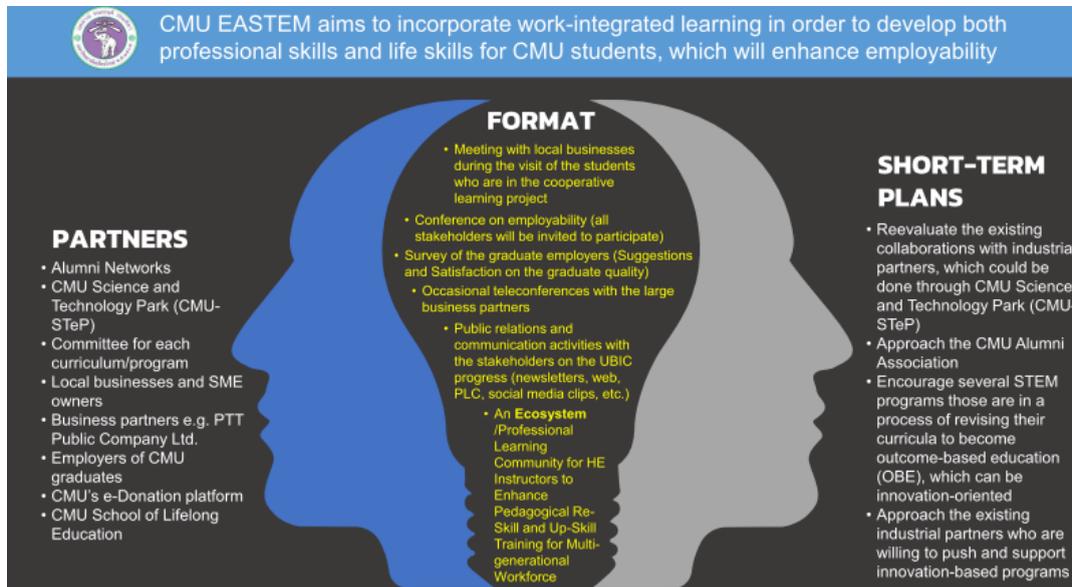
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The EASTEM UBIC canvas

A UBIC canvas was elaborated in EASTEM in order to:

- Assess partner current partnership approach and action plan
- Identify and share matches and mismatches in partner's WP4 approach
- Identify and share the impacts of changing STEM goals

As a tool for programme leaders and strategic stakeholders, it helped STEM Universities assess and develop strategic approaches to their partnerships with industry, incl. a set of 7 questions for programme leaders and University managers, which make up the basis of the EASTEM UBIC partnership canvas. This EASTEM canvas is inspired by the "university partnership canvas" developed by MIT and Siemens, 2018

<https://sloanreview.mit.edu/article/developing-successful-strategic-partnerships-with-universities/>

From the "business model canvas" developed by A. Osterwalder and Y. Pigneur in their book "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers" (New York: Wiley, 2010).

<https://www.elsevier.com/books/strategic-industry-university-partnerships/frolund/978-0-12-810989-2>



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MIT Sloan
Management Review

WINTER 2018
ISSUE

Lars Frølund
Fiona Murray
Max Riedel

Developing Successful Strategic Partnerships With Universities

For many companies, universities have become essential innovation partners. However, companies often struggle to establish and run university partnerships effectively.



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Usability on UBIC models

According to its authors, the canvas can help STEM programme leaders to define possible solutions to overcome any mismatches or tensions. It can also use the canvas to explore the impact of changing STEM goals on their existing Industry partnerships and, against this background, make timely decisions on what to change. The canvas can be a tool that corporations and universities use together to create transparency about the goals, formats, KPIs, and organizational structures of the partnerships under consideration for further development.

All ASEAN partners filled canvasses according to their UBIC priorities. After a short discussion, we shared that:

- 1 synthetic page is useful and clearer to share/discuss with stakeholders
- Some blocks hard to fill semantically
- Block Goals: too broad neither too restrictive. It is better, for example, to separate Goals in : global objectives, specific goals (focusing on something)
- Block Formats: A format item is sometimes already a good practice, some other times an activity to engage in or develop more in-depth for better quality/impact
- Block Action plan: using a 6 months frame for short (6m) medium (12m) or longer term (>12, after end EASTEM); Long term / Short term should be linked to each process/UBIC
- Link to the present situation ? (eg goals revised under Covid times)
- Temporality: to update or realign such canvas every semester (period), i.e. action plan time frame?; Maturity levels evolve once action plans initiated
- Coherency: overlaps between UBICs, addressing a UBIC sometimes echo an other on action plans, partners, or so; May we have 1 canvas per UBIC or one for all ? ... the linkage between blocks should be clarified as a management tool for quality enhancement to meet goals
- User's guide need
- For better usability/ergonomy, produce an XLS canvas to fill rather than a PPT or PDF with a background image



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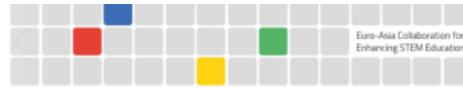
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**University-Business-Industry Collaborations
UBIC canvas**



Euro-Asia Collaboration for
Enhancing STEM Education



WP4 Action plan:

| | | | | | |
|--|---|---|---|-----------------------------|--------------------------|
| Institution: Chiang Mai University, Thailand | STEM programs: B.Sc. (in Biochemistry and Biochemical Technology; Microbiology; Physics; Materials Science) | Created for: EASTEM WP4 WG | Created by: Nuttlee (Tom) Suneo | Date: 16 Dec 2021 | Version: V 0.9 |
| FOCUS AREAS | | | | | |
| <p>UBIC-3: Professional work activities of students recognized in STEM curricula</p> <ul style="list-style-type: none"> To create students' experiences in working with the industry via cooperative and problem-based learning To develop both hard skills and 21st-century soft skills for university graduates. | | | | | |
| PARTNERS | GOALS | FORMATS | | | |
| <ul style="list-style-type: none"> Alumni Networks CMU Science and Technology Park (CMU-STeP) Committee for each curriculum/program Local businesses and SME owners Business partners e.g. PTT Public Company Ltd. Employers of CMU graduates CMU's e-Donation platform CMU School of Lifelong Education | <p>UBIC-3: Professional work activities of students recognized in STEM curricula</p> <ul style="list-style-type: none"> To integrate industrial partners in the program design & operation To obtain financial support from industrial partners for STEM activities To strengthen and expand networks with industrial partners in order to accommodate cooperative learning To collaborate with the industrial partners on human resource capacity building and on innovative startup development To cultivate partnerships between the university and industrial partners in order to facilitate innovation-oriented learning in the STEM-targeted curricula | <ul style="list-style-type: none"> Meeting with local businesses during the visit of the students who are in the cooperative learning project Conference on employability (all stakeholders will be invited to participate) Survey of the graduate employers (Suggestions and Satisfaction on the graduate quality) Occasional teleconferences with the large business partners Public relations and communication activities with the stakeholders on the UBIC progress (newsletters, website, PLC, social media clips, etc.) An Ecosystem and Professional Learning Community for Higher Education Instructors to Enhance Pedagogical Design Capacity in Imminent Re-Skill and Up-Skill Training for Multi-generational Workforce | | | |
| PEOPLE, PROCESSES, AND ORGANIZATION | | EVALUATION | | | |
| <ul style="list-style-type: none"> CMU EASTEM Steering Committee Head of CMU Alumni Network CMU Science and Technology Park (CMU-STeP) Committees for each curriculum/program CMU's e-Donation platform CMU School of Lifelong Education | | <ul style="list-style-type: none"> Nb of students having moved to companies during the curriculum, incl. duration in nb of weeks/ hours related to credits Nb of hours of industry visits per students Nb of credits in the curricula dedicated to WIL, to be aligned with the national framer of credits | | | |



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Designed and developed by Lars Frelund, Max Riedel, and Fiona Murray
Material remixed by Siegfried Rouvrais for the EASTEM project, 2020

Short term:

- Reevaluate the existing collaborations with industrial partners, which could be done through CMU Science and Technology Park (CMU-STeP)
- Approach the CMU Alumni Association
- Encourage several STEM programs those are in a process of revising their curricula to become outcome-based education (OBE), which can be innovation-oriented
- Approach the existing industrial partners who are willing to push and support innovation-based programs

Longer term:

- Gather other stakeholders (e.g. employers of the CMU graduates) who have been cooperative to provide feedbacks and input for previous curriculum developments.
- Encourage close ties with some business partners, e.g. PTT Public Company Limited.
- Integrate with Industrial Corporate Social Responsibility (CSR) programs those are interested in education-improvement type of projects
- Exploit the CMU's e-Donation platform, which is highly effective with an automatic filing of 2x tax-deductible
- Suggest CMU's policy on establishing the industry-university network in the region to help the development of education, problem-based learning, and academic activities.

Usability on ToT and STEM Center models

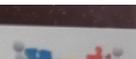
Some partners decided to test this canvas on two other concerns in the project: (1) Training of Trainers mangt (2) STEM centers mangt, will see if applicable by end of Feb2021.



**WP3 CANVAS
For Developing CMU STEM Center**



Euro-Asia Collaboration for
Enhancing STEM Education



WP3 Action plan:

| | | | | | |
|--|---|---|---|----------------------------|--------------------------|
| Institution: Chiang Mai University | STEM programs: B.Sc. and Non-degree program | Created for: EASTEM WP3 Working Group | Created by: Panwarit Charitwananant (Outside Chiang Mai, Current Edition) | Date: 8 Feb 2021 | Version: V 2.0 |
| FOCUS AREAS What are the key focus areas of STEM center? | | | | | |
| <ul style="list-style-type: none"> Educational Research and Innovation: Create and foster a STEM education research platform that allows the university staffs to collaborate on improving the quality of education, academic research, and community services through STEM education and multidisciplinary activities, and also collaborate with industry partners. | | | | | |
| PARTNERS | GOALS | FORMATS | | | |
| <p>(Who are your primary partners and by what criteria are they chosen?)</p> <p>Program Supporters and Collaborators</p> <ul style="list-style-type: none"> Teaching and Learning Innovation Center (TLIC) CMU EASTEM Thailand partners and EASTEM international partners CMU School of Lifelong Education Information Technology Service Center, CMU Committees of related curriculum/program <p>Stakeholders</p> <ul style="list-style-type: none"> The Institute for the Promotion of Teaching Science and Technology (IPST) Thailand Thailand STEM Education Center Thailand Office of the Basic Education Commission Thailand Office of Higher Education Commission (DHEC) Industry partners | <p>(What goals drive partnership and collaboration for developing your ToT platform?)</p> <ul style="list-style-type: none"> To promote student-centered learning, STEM education among the staffs. To stimulate pedagogical innovation in STEM education To train future mentors of STEM education (faculty members, K-12 teachers) To foster inter and cross disciplinary cooperation within the university, with industry, STEM higher education partners and K-12 schools. | <p>(What collaboration formats match your focus areas and the goals?)</p> <p>Collaboration with the supporters and collaborators</p> <ul style="list-style-type: none"> STEM education research and dissemination through publications or conference presentations. Develops training courses for university lecturers in Thailand on SCL and effective STEM based teaching. Support SCL teaching and learning through grants and publications. <p>Collaboration with the stakeholders.</p> <ul style="list-style-type: none"> Develop teaching and learning competences in the K-12 level through coaching. Promote and invite teachers to participate in STEM education training. Promote STEM education through curriculum/program and non degree program by industry partner collaborations. | | | |
| PEOPLE, PROCESSES, AND ORGANIZATION | | EVALUATION | | | |
| <p>(What people, processes, and organizational structures support your university collaboration?)</p> <ul style="list-style-type: none"> CMU EASTEM Steering Committee – plans and oversees all activities Committees of related curriculum/program – collaborate on Integrating SCL and OBE Teaching and Learning Innovation Center (TLIC) CMU – the main host of CMU EASTEM unit CMU School of Lifelong Education – helps execute the webinars and MOOC courses CMU alumni Industry partners | | <p>(What key performance indicators are most useful for evaluating your university partnerships?)</p> <ul style="list-style-type: none"> Nb of STEM education research and innovation Nb of ToT courses, webinars, workshops talks, etc. organized by the CMU EASTEM Nb of participants and satisfaction level of participants CMU staffs and the general public Nb of CMU courses implementing SCL Nb of industry partners involved in STEM platform Improved teaching results, increased learning effectiveness and quality of work life Graduate employability rate, Student satisfaction index | | | |



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Designed and developed by Lars Frelund, Max Riedel, and Fiona Murray
Material remixed by Siegfried Rouvrais for the EASTEM project, 2020

Short term:

- Promote STEM education research by publication
- Collaborate with industry partners and communities to contribute on curriculum development, non-degree training and feedbacks
- Provide training course to University staffs, teachers and interested partners

Longer term:

- Promote Digital Learning. Utilizing technology platforms that increase learning management, communication, and effectiveness of teaching and learning
- Outcome-based Learning. Establish new assessment goals and facilitate new approaches for student performance tracking and evaluation
- Promote lifelong learning in Thai educators especially on teaching pedagogy, technology and innovation

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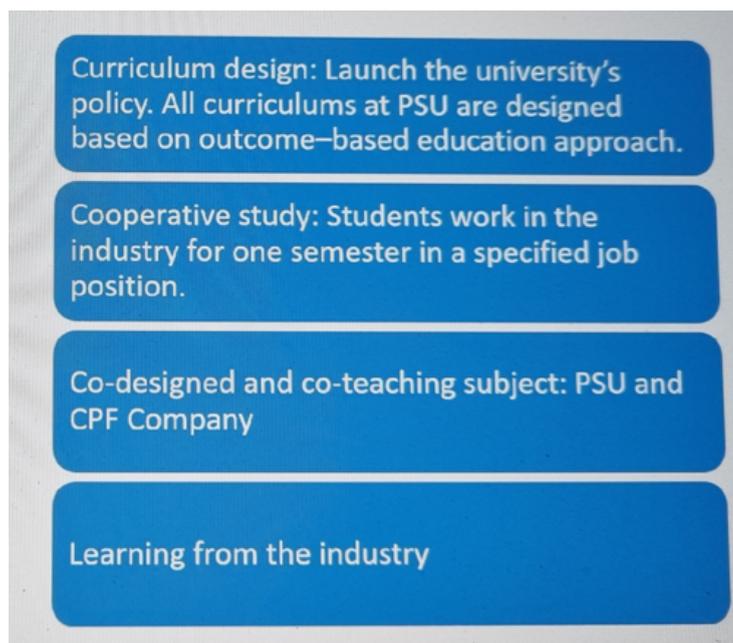
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Competence Framework

University and industry competency alignment for the new Industrial Age is now a consideration, but strategies, priorities, regulations, culture of change, and problem facing differ. But for enhanced UBIC, Industry and Academia values and actions need, however, to be shared, and collaboration reinforced. Resistance factors remain as stated by Morell (2014): 'Industry and academia have different cultures, different values, different needs and different expectations. (...) The biggest barrier that may exist is the failure to recognise that each sector has different needs.' In EASTEM partnership, by engaging with deans, vice-rectors and rectors in each institution, hopefully, UBIC models and guidelines are to be shared for proposing a reference model on governance including UBIC strategies and missions (strategic QA rather than functional QA only). For partners to effectively start or reinforce their competence integration process in their selected STEM programmes and STEM centres, aligned with industrial needs, reaching collaborative conclusions on how to adapt programmes with UBIC in the EASTEM framework is now a prospect.

Worth to be noted, the COVID-19 pandemic will change the future of work and students' employability and careers. As recently argued by Fernandes (2020), 'a global recession now seems inevitable. But how deep and long the downturn will be (...) also depends upon how companies react and prepare for the restart of economic activities.' How do STEM higher education systems cope with and will recover from the crisis? UBIC themes in STEM education in the post-COVID-19 are to be further explored.



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**Specification of
Field Training Experience
(SCIN 203)**
12-16 July 2021

- Competency Development Workshop
- Enhance students' knowledge before internship

FESTO



SIEMENS



Canon

FOXCONN



Longer-term Plans :

- Gather other stakeholders (e.g. employers of the CMU graduates) who have been cooperative to provide feedbacks and input for previous curriculum developments.
- Create close ties with some business partners, e.g. PTT Public Company Limited.

Longer-term Plans :

- Integrate with industrial Corporate Social Responsibility (CSR) programs those are interested in education-improvement type of projects
- Exploit the CMU's e-Donation platform, which is highly effective with an automatic filing of 2x tax-deductable
- Suggest CMU's policy on establishing the industry-university network in the region to help the development of education, problem-based learning, and academic activities.

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Institut Teknologi Bandung WP4

Industry collaborations incorporated in the curricula:

bangkit!
Google gojek tokopedia traveloka

A structured, high quality, training program to produce high-calibre graduates for world-class technology companies.

A collaborative game development training by a renown top game company.

Agaté ACADEMY

... and more collaborations with ~30 companies/institutions under Ministry's certified internship and training programs.

bukalapak
Microsoft aibli Grab dicoding BNI
Telkom Indonesia TELKOMSEL
DANA Vidior ... and more

Freedom Campus Competitive Program (PKKM) Digital Innovation and Entrepreneurship DIGINOVE

- ✓ An ITB's initiative for sustainable efforts in strengthening software industry ecosystem in the era of digital advancement through innovation and entrepreneurship.
- ✓ Strong collaborations with digital industries.

New Study Program: Classes in Jatinangor Campus

- ✓ Encourage multidisciplinary collaborations among students in Informatics, Information System & Technologies, Visual Communication Design, and Entrepreneurship study programs.
- ✓ Inviting industries to provide real-world experiences for students

UBIC-3: Professional work activities of students recognized in STEM curricula

- To create students' experiences in working with the industry via cooperative and problem-based learning
- To develop both hard skills and 21st-century soft skills for university graduates.

Program design & operation

- Industrial connections through CMU Science and Technology Park (CMU-STeP)
- Connections through CMU Alumni Association
- Connections through other stakeholders (e.g. employers of the CMU graduates)

Co-financial support

- Strong business partnership, e.g. with PTT Public Company Limited.
- Industrial Corporate Social Responsibility (CSR) programs
- CMU's e-Donation platform (automatic filing of 2x tax-deductable)

Innovation-oriented learning/curricula

- Several STEM programs are in a process of revising their curricula to become outcome-based education (OBE), which can be innovation-oriented
- Industrial partners are willing to push and support innovation-based programs

Cooperative learning

- University's reputation makes it attractive for future partnerships
- Feedbacks from past operations of coop learning programs
- Established industry-university network to guide professional education, problem-based learning, and academic activities.

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| WP4 | Date | Main aim and short description of the activities |
|--|---------------|---|
| Integrate industry requirements and student-centered teaching approaches into educational programmes | | |
| Sharing research result for Quang Nam province | April-2021 | Making a collaboration in research; Agreement for students HUSC to learn practice from companies in the province |
| Signing agreement with TMA Solution company | December 2020 | Research cooperation; Developing human resource; Student Recruitment (from HUSC) |
| Signing MOU with Apply Science Institute – Van Lang University | January 2021 | Cooperation in research and technical transfer; Student exchange |

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UTEHY-WP4 part 2 Processes for competence integration

1. Invite alumnae give a speech in first day of school ceremony/a school-year ending ceremony.
2. Collaborate with industry & alumnae to review curriculum
3. Cooperation in developing output standards, training programs;
4. MOU with industry for internships
 - HCL Vietnam Company Limited (IT)
 - Canon (Electronics)
 - Ford (Automotive)
 - Mitsubishi (Automation)
 - Towada (Electronics)
5. MOU with National Economics University

- defining the role of businesses in curricula
- find, build and maintain relationships with businesses in the fields of engineering such as Electrical, Electronics, IT, Automotive...
- design specific modes and activities of cooperation between university and businesses
- collect and use feedback from businesses to edit and develop training programs

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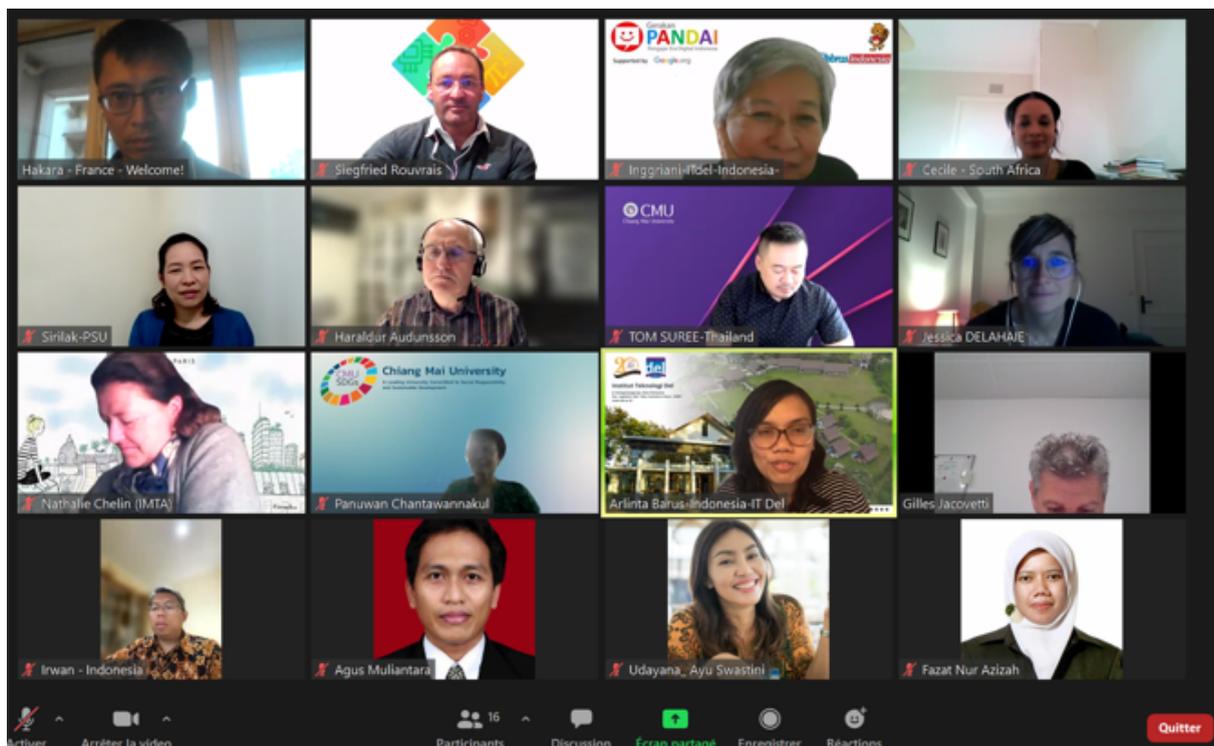
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Chapter 4: Collaboration for Competence Integration

Collaborative Quality Enhancement

In order to foster competency orientation of STEM educational programs in a continuous manner, students' transversal skills were addressed on a strategic level via a collaborative transferable workshop.



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Systemic Design training via a Climate Fresk



THE CLIMATE COLLAGE

You're holding all the cards

WHAT IS IT ?

THE CLIMATE COLLAGE IS A SCIENTIFIC, CREATIVE AND COLLABORATIVE WORKSHOP DESIGNED TO LEARN ABOUT CLIMATE CHANGE IN A FUN WAY.

Both educational and fact-based, this workshop can help you discover rapidly how climate works and the causes and consequences of its disruption. Taking part in this workshop will help you grasp the **complexity** of climate change, have an **overview** of this vast issue, and **understand** how to act efficiently.

In addition to providing **scientific facts**, the Climate Collage develops participants' **creativity** and communication **soft skills**.

This tool was created and shared under a Creative Commons license by **Cédric Ringenbach**.

WHAT DO YOU NEED TO CREATE A COLLAGE ?



A set of Climate Collage cards



A team of 4 to 8 players



An expert moderator and coordinator



A 3 hour workshop to think, create and share



Some equipment (a table, paper, pens, pencils, tape, etc)

HOW DO YOU PLAY ?

It's very simple.

Players form **teams of 4 to 8 players**. They are given cards which represent different components of climate change and together they **link causes to effects** and place the cards so as to show these links.

A moderator coaches one or several teams to guide them through the workshop, make sure there is good communication within the team and provide extra information.

THE 4 STAGES OF THE WORKSHOP:

- 1 1h - REASONING:** discovering and linking the cards and creating the collage.
- 2 1h - CREATIVITY:** relaxing, tuning the collage and creating a team spirit by decorating it.
- 3 15' - PRESENTATION:** share what you learnt and consolidate it with a concise presentation.
- 4 45' - BRIEF:** a calm discussion of players' feelings, positions, questions and solutions.

To facilitate collaboration between EASTEM partners during the travel restrictions in 2021, a Climate Fresk⁴ workshop was first implemented online. Climate education offers a workshop to raise awareness of climate change issues (www.fresqueduclimat.org). It promotes individual and / or collective awareness and facilitates a constructive discussion, creating a will to act in the face of the challenge of an ecological transition (cf. Figure), of direct interest for STEM education.

⁴ https://www.youtube.com/watch?v=mbl_X6eR758&feature=emb_title

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Figure. Climate Fresk sample in 2021 with students at IMT Atlantique

The mural online tool was discovered by most of the project WP4 members, step by step, in a half day working session with two groups..



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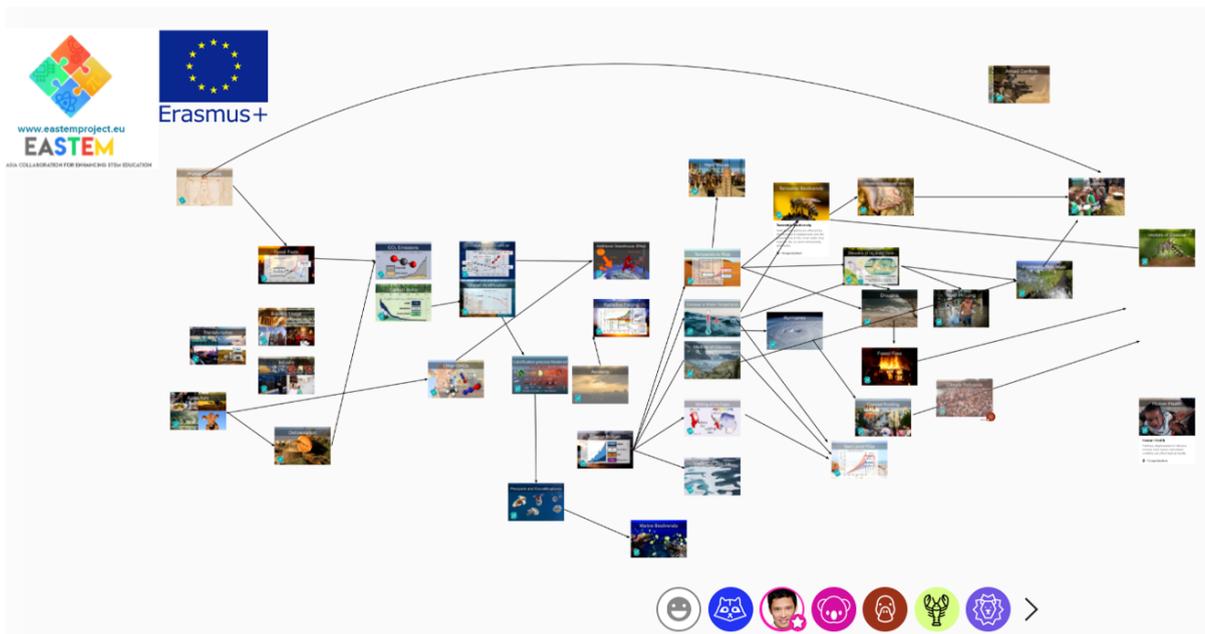


Figure. online with EASTEM curriculum designers

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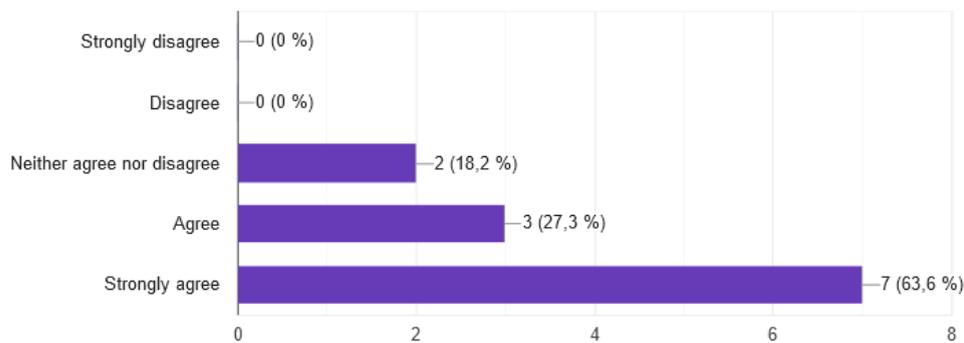
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Feedbacks on the collaborative design experience

A qualitative and quantitative questionnaire allowed for analysis to identify the pros and cons of preparing the design of the EASTEM Curriculum workshop. The feedback primarily related to duration, group size, rhythm, STEM topic alignments, pros and cons, and the use of the Mural tool. Overall, it was found to be a pedagogically fruitful workshop to engage in systems thinking and intercultural cooperation. As a cooperative design, overall 60% of the participants liked the CF workshop (strongly agreed), 30% agreed, 20% neither agreed or disagreed (Likert scale).

Overall, did you like this Climate Fresk.Collage ?

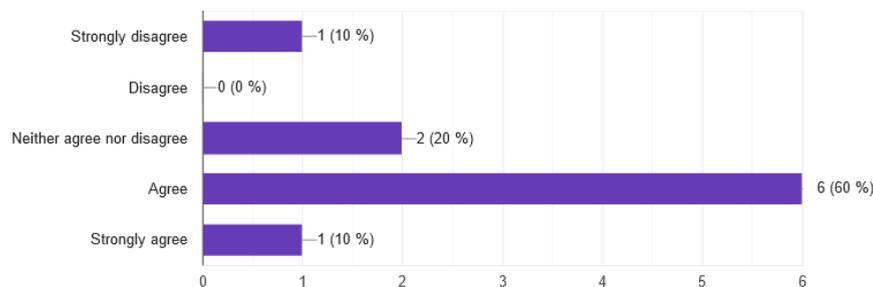
11 réponses



Do you plan or have in mind in the future to integrate this Climate Fresk workshop in your context (eg personal level or at your University, company), eg. thanks to national correspondants (cf. 50 countries involved) or animator Hakara Tea or someone else ? 

<https://climatefresk.org/contact/> (ID) Camille Théron indonesia@climatefresk.org; (VN) Quang-Tran Dao vietnam@climatefresk.org, (TH) Blandine Bascouert thailand@climatefresk.org.

10 réponses





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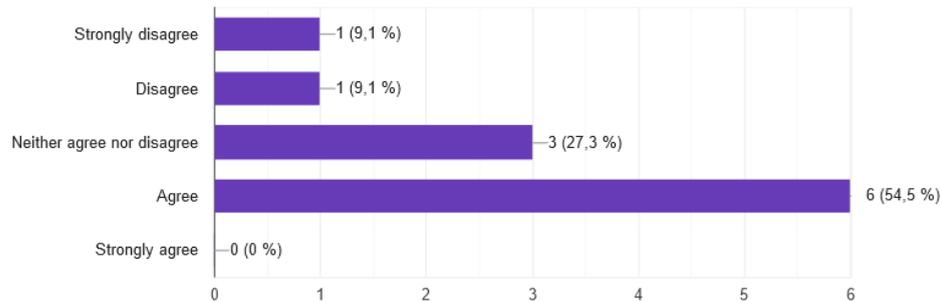
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Do you envision to become an animator for this Climate Fresk or expect that your STEM center or some pedagogical innovators at your University could become Climate Fresk facilitators (FYI 3 hours training ToT model, online or face-to-face to be an animator) at local or national level ? <https://drive.google.com/file/d/1pQc2dCCyOLihxPjsjicWBmGPW6IA13uF/view>



11 réponses



Twenty-five percent appreciated (strongly agreed) that collaboratively using cards in a design and system thinking workshop can be beneficial for a future EASTEM Curriculum workshop, 50% agreed, 12,5% neither agreed or disagreed, and 12,5% disagreed.

What about you general good feelings or critics about this Climate Fresk workshop (duration, group size, rhythm, STEM topic alignments, pros & cons, tool, etc.) ?



- Timing too long, transfer to EASTEM not clear
- Pros: Interactive learning, Instructor explains clearly about climate changes. Cons: It takes too long. Maybe the organizer could reduce numbers of the cards next time.
- Working with participants from diverse contexts. Learned about climate change. It was a bit challenging to fully participate due to not having enough knowledge about the topic but I found it very interesting. Perhaps try to pre-determine levels at which participants join and then make slight adjustments. Perhaps have a "leader" for a group (in breakout rooms) who can give some direction and keep the momentum.
- It was fun but the session is a bit too long, tools are great!
- Overall I had good feeling about the workshop, and mural worked fine for online collaboration (but on site would be even better I presume). It was informative to see how others approached the topics, and global warming in general. And the briefing in the end was informative, with relevant and easily related examples. Each card has plenty of information, so possibly fewer cards to be presented is one option to consider to permit a bit more discussion within groups. Regarding STEM education, topics on the cards are very much in line with topics in STEM education (and invite quantitative estimates or calculations). At the moment I am keen on introducing this kind of event in some introductory course(s) at my university.
- A good system thinking game about current issue. Duration, group size, rhythm is appropriate for online meeting, and "busy" people like me. Maybe it will be better to have a longer duration and 2 or 3 breaks between. The tools are interesting
- too long
- Everything is perfect, just the session perhaps can be split into 2 shorter batches.
- I think the duration was a little bit too long. If it was done within 1.5 - 2 hours it would have been perfect.

on a "University of the Future" curriculum design workshop, via Mural online tool before the end of the project (Nov-Dec 2021), what do you suggest? (e.g. max duration, objectives, group size, categories of cards as EASTEM SCL/ToT/Centers/UBIC, content description of cards, Mural or other tool for collaborative design thinking, alignment canvas, original ideas to stimulate motivation, gameplay, phases, etc.). All ideas welcome !

- reflexion on course
- In November, around 3 hours.
- I like the idea
- Max duration: 2 hours. group size: 12-15. Tools: Mural is OK if it is free, Content Game description etc: later (need more time to describe
- Can be divided into 2 days meeting, each is one hour
- Maximum duration should be within 2 hours. I'm not too sure about using Mural as it has a bunch of limitations.

Best practices from the Climate Fresk were identified and discussed, which were then further explored in the novel EASTEM Curriculum workshop.



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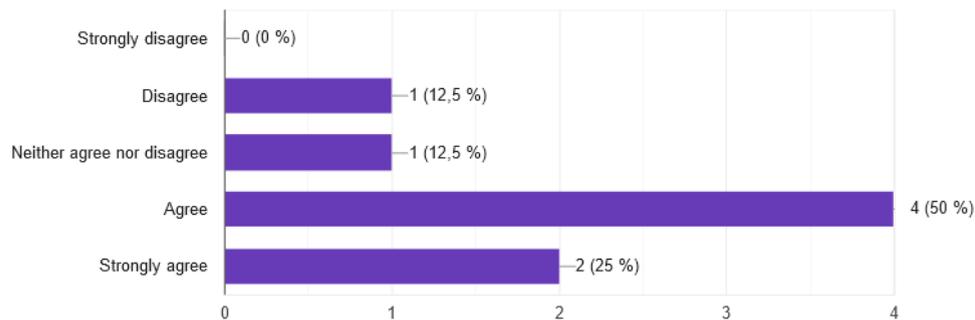
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For EASTEMers only to reply: Collaboratively using cards in such design & system thinking activity is to be beneficial for an EASTEM "University of the Future" curriculum design workshop (not implemented yet), linked to advices on process for how to integrate competence development for students into education programmes and university strategies ?



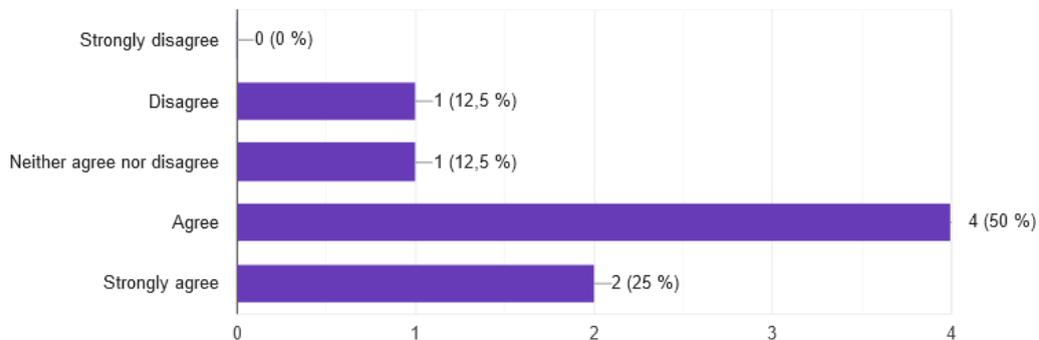
8 réponses



For EASTEMers only to reply: Having a 2-3h workshop in EASTEM on a "University of the Future" curriculum design online activity would be valuable in the short term to meet some EASTEM project objectives?



8 réponses



Continuous improvement

| Level | Description |
|-------|---|
| 5 | Continuous improvement and development is evident |
| 4 | Evidence of implementation and measurement of effectiveness are available |

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| | |
|---|---|
| 3 | Implementation is underway |
| 2 | A plan to implement change has been produced |
| 1 | There is an awareness of the need to implement change |
| 0 | No intention to change |

EASTEM Curriculum workshop

Concerns around the quality of HE impact teaching teams, students (Lassudrie et al., 2013), and industrial partners (Rouvrais et al., 2020), as well as facility and financial support, especially in developing countries. The EASTEM Curriculum workshop was designed with the aim of developing collaboration between training managers, program directors, teachers, students and industry. In order to "get out of its own walls" and exchange in complete neutrality, the groups are mixed between stakeholders and institutional cultures to "draw" the main lines of an imaginary training program, resilient to the unforeseen. Under a serious game schema, and informally following some design thinking methods, the EASTEM Curriculum workshop stimulates a collaborative innovation in curriculum redesign with a view to ensuring continuous improvement of programmes.

The EASTEM Programme of Utopia

• Material:

- short textual stories incl. mission and quali/quantitative requirement data
- no "tapis de jeu"
- Whiteboard or blank poster, with color pencils
- some cards
- prefilled WP4 canvas template

• Activity training time:

- 2 to 3 hours in a workshop style
- 4 categories/focus of cards
 - WP2/SCL,
 - WP3/Centers,
 - WP4a/UBICs,
 - WP4b/tools-processes
- No winners, no formal scoring/ranking or assessment, a collaborative card workshop with various teams or a single team





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The EASTEM Curriculum workshop was mostly inspired by examples of serious games, which facilitate stakeholder collaboration and cooperation to help identify alternative strategies and structural solutions. As an example, University of Utopia is a serious collaborative game intended for HE teachers (Laplanche and Escrig, 2019). It allows pedagogical concepts presented via concept maps to be transferred to teaching situations defined collectively in order to improve the quality of learning activities. The participants develop a mono and multidisciplinary educational activity project on a poster.

The first trial of the EASTEM EASTEM Curriculum workshop was run on the Mural online tool with international participants. The Miro or other collaboration tools could have also been used. Participants shared insights into the curriculum, which they already had in their educational context.

| | Miro | Mural | Klaxoon |
|------------------------------------|------|-------|---------|
| NB Templates | 100 | 200+ | 200+ |
| Integration with other apps | 100 | | 20 |
| Integrated video conference | X | | X |
| Audio calls | | X | |
| Screen sharing | X | X | X |
| Chat | X | X | X |
| Timer | X | X | X |

Six drawings were proposed, e.g. curriculum architecture of all study programs in ITD (with four Faculty and three domains), a postgraduate diploma in Business Administration with course structure, pillars and structure of a biomedical engineering BSc., an industrial design engineering bachelor with flexible choice based curriculum.



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Curriculum Design Workshop, 25th Nov 2021

Ingniani: This is the curriculum architecture of all Study Program in ITD with 4 Faculty and 3 domains (Computing, Industrial Engineering and Bioprocess). Institut Teknologi Del >> Engineer. A bar chart shows the distribution of courses across faculties and domains.

Cecile: A slide titled 'WHO SHOULD APPLY?' and 'ARE YOU APPLY?' with a table of requirements and application details.

Haraldur: Constructing program in Biomedical engineering, BSc. A diagram shows the relationship between foundational, multi-disciplinary, and general courses in engineering.

Sigfred Hornumskald: The what of a B.Sc. Programme 120 ECTS... >A delicious & sweet Burger for young adults <?. A burger-themed diagram maps course components to burger parts: 70% SKILLS & COMP (Cult Course, Seminars, Long PBLs, etc.), 30% KNOWLEDGE (Career Prep, Lab. Skills, etc.), and Core Basic Sciences (Math, Phys, Chem, etc.).

Collaborative: BSc CyberSecurity, Sept 2022. A hierarchical diagram showing the structure of the CyberSecurity program.

Suzanne: Industrial Design Engineering. A circular diagram and a table showing the structure of the Industrial Design Engineering program.

Among the six, as an example, the proposed burger-styled curriculum inspiration came from a meeting in Paris in June 2014 with the UpCERG group from Uppsala University, IMT Atlantique, and Aalto University. It was recognized as attractive and flexible, but with few temporal links between abstract courses. As a metaphor, it offers a kind of menu for curriculum blocks. The workshop highlighted how architectural representations of the curriculum suggested by the international participants varied considerably, both from a structural point of view and from the informal artefacts used. Participants however reflected on the fact that there was a lot of paperwork, administration, and sometimes little freedom, with respect to the university curriculum framework, accreditation standards and other requirements.



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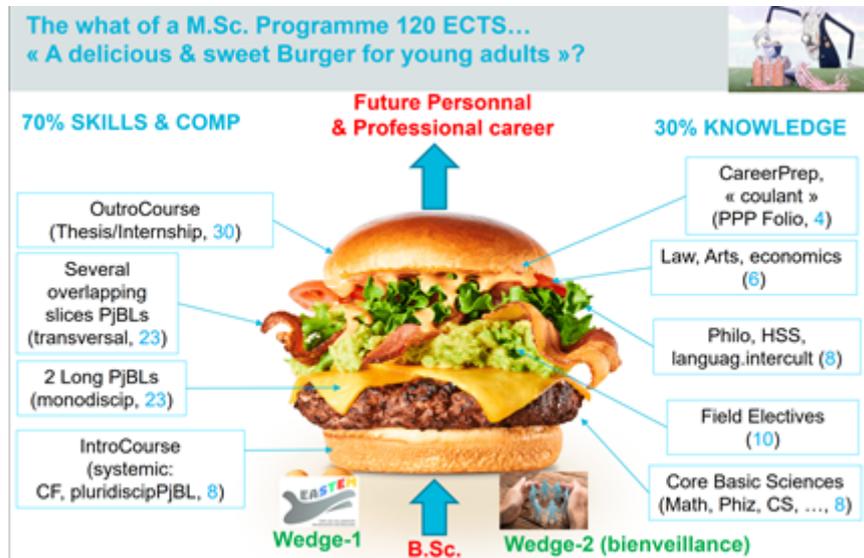


Figure. Curriculum drawing sample.

A cooperative approach was then used, considered as a macro-strategy for building, revising, or transforming programs. Five participants were asked to cooperatively sketch a EASTEM Curriculum, echoing arbitrarily a BSc in cybersecurity. The participants however experienced challenges in designing a common understanding and reframing the problem in a human-centered way. They were questioning the main aim, problem, assumptions and implications. As highlighted by one participant, it often takes very long to develop new programme architectures, and that other challenges arise, such as deep managerial perspectives, resistance to change, and inertia of administration, which could limit the innovation and freedom for redesigning existing structures.

The EASTEM Curriculum workshop, held as a trial in Fall 2021, aims to identify alternative curriculum design strategies as curriculum solutions which may not be instantly apparent. It questions the problem and investigates whether it is possible to reconcile HE stakeholders with cooperation design, in order to create a common understanding and develop a collection of hands-on methods for curriculum transformation in VUCA contexts. The main purpose of the EASTEM Curriculum workshop is to train curriculum designers to share a common understanding with intercultural colleagues and team members, to later transform (redesign/reform) their own curricula according to local challenges, traditions, culture, etc.



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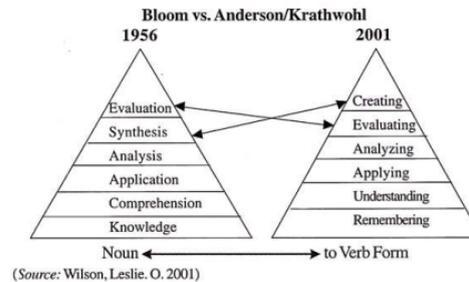
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Learning Intentions

Learning Objectives of this workshop, participant perspective (EASTEM trainers, programme designers, etc.), according to the Bloom taxonomy, are “being more capable to”:

- **cite and describe** EASTEM concepts in university and STEM pedagogy
- **understand** how a concept, taken in isolation from the others, when activated in a STEM educational activity, promotes competency development and employability of the student
- **understand** how EASTEM concerns & concepts relate to each other and why
- **sketch/design** a STEM course or programme aligned with enhancement of student competence and their employability
- **evaluate** a given STEM course or programme by explaining the concepts which have been activated and those which have not been or which have been inhibited
- **modify** an existing STEM programme educational based on new requirements to improve competence development of STEM students
 - propose improvements or redesigns to an existing STEM course or programme or create an integrated STEM T&L activity promoting competency development and employability of the student



Workshop feedbacks

Questionnaires were developed in order to provide a first round of feedback on the participants' experiences of this workshop. The EASTEM Curriculum workshop concluded with a debriefing session and dialogue. Table indicates preliminary elements of analysis, based on feedback from the questionnaires.

Table. SWOT of the EASTEM Curriculum trial workshop.

| Strengths | Weaknesses |
|--|--|
| <ul style="list-style-type: none"> • Collective work in favour of acting together • Based on plural and international experiences • Sharing good practices and enrichment • Serious playful games in accordance with motivational factors • Flexibility and freedom of graphic language for the design-thinking phase | <ul style="list-style-type: none"> • New approach with that needs appropriation of tools and techniques • No real concrete feedback yet quantitatively and qualitatively analyzed • No immediate post-workshop application under a concrete continuous improvement approach to programs |
| Opportunities | Threats |

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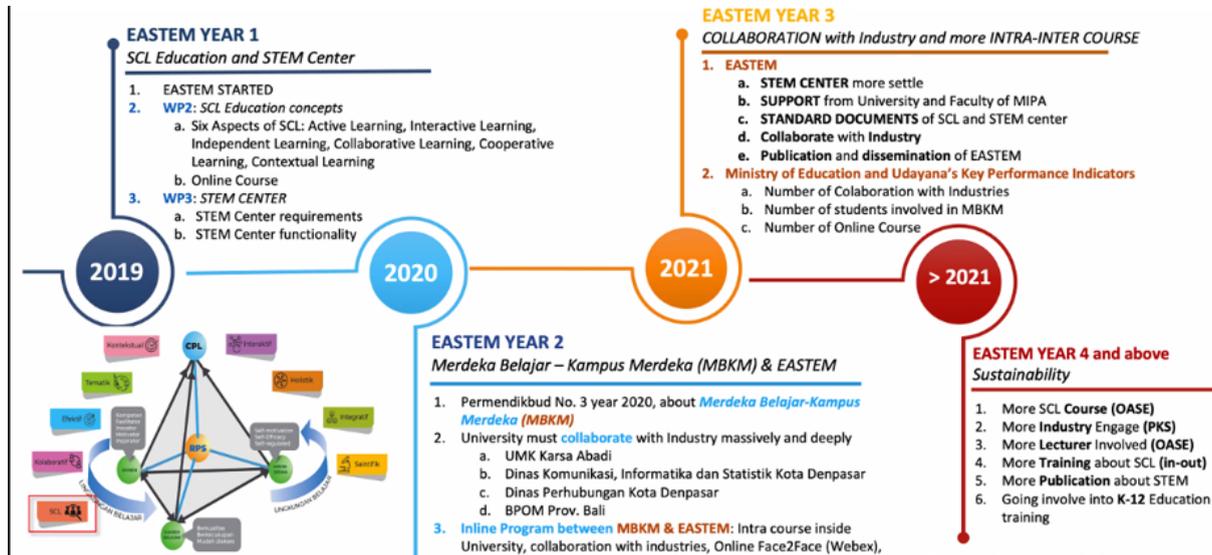
| | |
|---|--|
| <ul style="list-style-type: none"> ● Flexible and intuitive representation language ● Transferable to other disciplines ● Transferable to other universities or programs ● Potential sharing of strategies, goals, action plans and quality indicators of the developed outlines ● Agility and resilience analysis support | <ul style="list-style-type: none"> ● Modeling curriculums too restrictive by a graphic language too formal ● Lack of support from decision-makers due to the variety of participants ● Loss of motivation of partners with regard to repetitive serious games ● Competitiveness between participants with regard to transparency |
|---|--|

Participants highlighted the value of being able to hear the experiences of other, especially international perspectives. There was some value in the metaphors-direction, to help people think about curriculum as something other than just a timeline of courses planned over three or five years. The hamburger abstract design, in particular, was especially received well and led to the other participants thinking more creatively, as well during the second collaborative phase; thus, emphasizing different characteristics of a curriculum. Yet academic HE programs share common artifacts. To date, there is no global and unified framework for visualizing and discussing curriculum designs.

HE has become a global village, “a vibrant, bustling marketplace, where students from all over the world set up” (Gourvès-Hayward et al., 2013). The EASTEM Curriculum workshop allowed the authors and participants to identify many intercultural, professional and personal skills and aptitudes, which are mobilised by the participants. Problems of cross-cultural adaptation however remain. As noted by Kennedy et al. (2019), design and implementation of a programme may be influenced by cultural methods for conducting business and maintaining knowledge integrity, by taking interdisciplinary teams of academics on a journey towards ‘curriculum reconciliation’.



Transformation of curricula



For EASTEM sustainability in 2022 and above, and to address the question of STEM curriculum agility and resilience, implications and recommendations along with models, methods and tools aimed at developing a EASTEM Curriculum framework, were discussed. The aim was also to bring together ad-hoc practices around agile thinking, with tools, from a playful and virtual perspective. The workshop also brings together sharing, conceptualization and collaboration, beyond the skills of the participants, around the design of agile and resilient curricula.

Target groups

The EASTEM community presents an opportunity to allow organisations to increase the quality and relevance of curriculum design activities and to increase capacity to operate jointly at transnational level for programme inter-operability.

The proposed EASTEM Curriculum collaborative workshop can assist HE institutions to pave the way towards a EASTEM Curriculum Framework, which can also help improve the quality and relevance of their curricula, and allow for international collaboration to facilitate innovative curriculum design activities, by exchanging or developing new practices and methods, and inspiring and learning from others.

The workshop can assist curriculum developers and facilitate resilience of educational systems facing VUCA events. The tool paves the way to resilience investigations within a curriculum framework, to include models, methods, and processes transferable to local institutional contexts according to the local needs and challenges, for curriculum renewal,



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EASTEM project report, deliverable D4, February 2022 transformation and reconciliation. The tool challenges assumptions, strategies, alternatives, implications and foresight solutions. The EASTEM Curriculum workshop is a preliminary activity, to highlight why and how collaboration is needed between different stakeholders to open mindsets and innovation. On an international scale, the EASTEM Curriculum workshop demonstrated that collaboration of all stakeholders in design can be done effectively with serious games using various online tools.



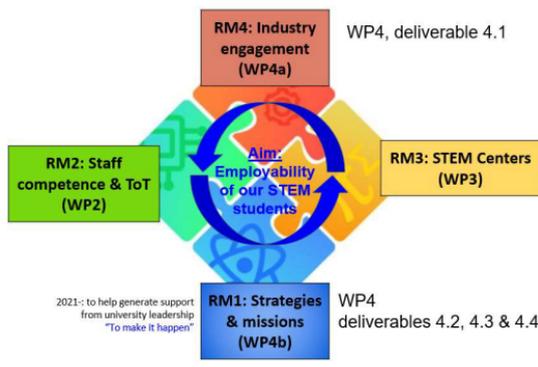
Idea: The EASTEM Programme of Utopia

• Aim:

- in a small team, propose a STEM programme design according to requirements given by some cards

• Intentions:

- provide coherency to EASTEM WP2, WP3 & WP4 for applicable good practices (formats) to (i) integrate competency approach & (ii) enhance student employability in partner STEM programmes (the two main EASTEM goals)



• Target Groups:

- Trainers & teachers at partner institutions
- STEM Programme developers, managers and leaders at partner institutions, deans,
- Educational advisers, pedagogical engineers

• Workshop Model:

- Workshop with cards on 4 focus (per WP)
 - each card has one of the 4 colors
- Teams of 3-5
 - each team receive a small nb of cards
 - each team design and present a STEM programme
 - other teams provide feedbacks

Transferability

With the main aim of facilitating continuous improvement of the quality of teaching and learning (Bennedsen and Rouvrais, 2016), the workshop operated without any real constraints in terms of modeling, able to guide actors in HE to collaborate more effectively in their curriculum reforms. This informal and cooperative workshop makes it possible to start to act together in the construction of action plans in connection with strategies set by Universities, Ministries or accreditation systems.



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Applicability

- Usable in the STEM centers via a ToT workshop to reflect on programme design with curriculum designers and teachers based on the EASTEM main WP2/WP3/WP4 concepts



In our VUCA times, the present impact of the "turbulence" on the curriculum is being experienced worldwide. Many HEs suffer because they have a rigid curriculum, with specific courses which are fixed. It is critical that the curriculum is both agile and resilient. As an example, in Indonesia, the Ministry of Education started to run the MBKM (Independent Learning- Independent Campus), formed at the beginning of 2020. Students of the 4-year bachelor program are given the freedom to take the opportunity to spend one semester outside the study program and two semesters of carrying out learning activities outside the university. The credits of those semesters are taken into account in the academic transcript. It means that the curriculum must support a "big room" for MBKM activities and its credits. If the curriculum is not agile or is not resilient, it creates problems for the study program. Students learn and gain experience from real world professionals, by doing the activities outside the university, especially through internships (in industry, government offices, research centers or in the community).

Perspective

As a first recommendation, an EASTEM Curriculum Framework could be investigated, to include models, methods, processes and tools for guiding transformations of STEM programmes. As a starting point, graphic languages for the representation are to be studied, as a system modeling approach makes sense to meet such challenges of exchange and interoperability.

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Drawing on the initial quantitative and qualitative indicators that were developed, an impact analysis could be carried out, with the support of local educational centers in partner universities (cf. network of STEM centers⁵). In line with the specific contexts, institutional cultures and specific strategies of the participants, the EASTEM Curriculum workshop is transferable more locally in order to support the transformation or reform of educational programs in a university. With the aim of raising awareness and training stakeholders in the engineering of training programs, the EASTEM Curriculum workshop would benefit from relying on a learning model adapted from the experiential learning cycle such as that of Kolb (1984).

EASTEM Card

The workshop relies on 40 cards, each presenting an EASTEM concept and few stories as starters

The front of the card is structured as follows:

1. EASTEM concept category, among the 4 categories:
 1. SCL style (green)
 2. STEM center (yellow)
 3. UBIC (orange)
 4. QE processes (blue)

The color of a card depends on its category
2. EASTEM concept name (WP focus)
3. description of the concept, presented in non-technical language, from the perspective of what the teacher does in a teaching activity to activate the concept. A file exists incl formats and good-practices to meet the concept/focus
4. additional information justifying the importance of the concept, which may lead to other concepts
5. a bibliographic reference

The back of the cards contains the EASTEM puzzle logo part of the category/focus (e.g. blue piece, green piece, a.s.o)



1. Industry Collaboration
2. UBIC2: Industrial and Business partner's participation in STEM programme T&L activities

3. The course/programme includes more than 30% of T&L activities with external industrials

4. Presence of industrials in the STEM reinforce competency orientation

5. Morell L. (2016)

The EASTEM Curriculum workshop may be complemented with concept cards to guide participants to identify more specific strategies and solutions. In the first phase, the participants, in sub-groups, will initially have a few cards in order to design a training program under certain constraints. As a perspective, the workshop may be complemented with concept cards to guide participants to identify more specific strategies and solutions, to develop a shared collection of good practices in curriculum transformation. Cards will make it possible to address several axes, e.g. priorities in terms of graduate outcomes, educational constructive alignments, internal and external partners in the program, strategies and missions, and processes leading to continuous improvement. In a first phase, the participants, in sub-groups, will initially have a few cards in order to design a training

⁵ <https://www.fsf.vu.lt/en/eastem-centers-platform>

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program under certain constraints, classified into categories: skills approaches, training of
trainers and educational assistance, industry-university collaborations, or missions and
strategies of an institution.



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In proceedings of the [16th International CDIO](#) Conference, hosted on-line by Chalmers University of Technology, Gothenburg, Sweden, 9-11 June 2020.
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Contributors

EASTEM project is an inter-institutional collaboration which includes a process in which parties (individuals or institutions) work together to achieve project goals. EASTEM knowledge is shared through regular open discussion during plenary project and ZOOM meetings from March 2020. All EASTEM partners share values and ideologies around the project objectives. This EASTEM report, as project WP4 deliverable, is a joint authorship: several authors have participated and whose contributions cannot be separated one from the other. The property of this document content is the one of all the corresponding authors.

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|------------------------------------|--|
| Lead Organisation | WP Coordinator: IMT Atl. |
| Participating Organisations | ASEAN partners: CMU, HCMUTE, HUS, ITB, ITD, MU, PSU, UGM, UNUD, UTEHY European partners: IMTA, VU, UU |

More precisely, there is generally a 'leader' of the collaboration for this report:

- At IMT Atlantique, Siegfried Rouvrais was responsible of this report writing process,

A collaborative project can not exist without the active implication on several stakeholders in the partnership. Several members actively collaborated for this first EASTEM report, formally as subsection producers or during informal discussion during project meetings or join staff training events. They include in alphabetical order:

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