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A Decision Skills Framework for Higher and VET students, continuously integrative for educational programme addressing VUCA contexts

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Good Decisions at Right Times

Deliverable O3: A Decision Skills Framework for Higher and VET students, continuously integrative for educational programme addressing VUCA contexts

Version 1.5, May 9th, 2020

DAhoy recommendations for programme leaders
& curriculum designers in Higher and VET education



Preamble

DAhoy project is an Erasmus+ KA2 Strategic Partnership to support Innovation. Its name should be understood as “DecisionShip Ahoy!”, a reference to A. G. Bell, the Scottish-born scientist who patented the first telephone and originally suggested 'Ahoy' as the standard greeting when answering a call.

The project purpose was to investigate, over 3 years (2017–2020), innovative educational ideas around Decision-Making to deeply reinforcing Decision Making skills for integrative educational programmes wishing to address VUCA situations, both in Higher Education (HE) and Vocational Education & Training (VET), for continuous development of HE and VET practices. This 2020 report presents the DAhoy VUCA decision skills educational framework.

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Introduction

The 2020 COVID-19 crisis is changing the nature of work, of workers, and of workplaces. The university's responsibility is to train STEM students who are global citizens, agile and capable of taking decisions in challenging situations. Before the crisis, technological universities were aiming to produce 2020 STEM graduates with T-shape skills, meaning that they have good depth of knowledge and skill in one discipline, and a reasonable breadth of knowledge and skills across multiple disciplines, thus transferable skills as for judgement and decision-making.

Recovery after the crisis is as important as coping with the ongoing COVID-19 crisis itself. Because the VUCA context is now more prevalent, transversal skills reinforcement is more than needed, and there is a great opportunity for STEM universities to revise programme outcomes and aim for V-shaped perspectives for their graduates. V-shaped people grow in knowledge and skill, they grow in spiral fashion both horizontally and vertically.

A global recession now seems inevitable. Now is a great opportunity to reshape STEM education, with V-shape flexible curriculum more explicitly. V-shaped people are the kind that we need for the post-COVID-19. To better prepare students, the future professionals that will organise the economic recovery for the post-COVID-19 era, more emphasis should be placed by STEM programme managers on flexible curriculum structures and the newly required transversal skills, including decision-making and career concerns. These skills should be on the immediate agenda at universities for a more resilient future. DAhoy proposes several recommendations for these challenges.

Project context

DAhoy supports the coherent inclusion of active and engaging pedagogical models, to better prepare learners and professionals to face VUCA situations (e.g. pandemic, natural disasters, etc.). The second is to investigate Decision Making as a transversal skill, with three complementary dimensions:

- Math-based Decision Making, with rationality;
- Social-based Decision Making, including people's interdependencies and social identities;
- Career-based Decision Making, to better choose personal career path.

The three dimensions are not to be weighed, it's a virtuous ecosystem.

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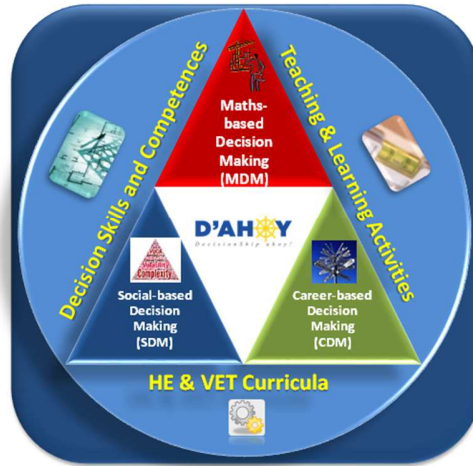


Figure. The DAhoy 3 dimensions of Decision Making.

DAhoy defined and evaluated innovative Teaching and Learning (T&L) activities to be integrated in educational frameworks at a systemic level, in line with the Bologna processes and quality assurance purposes, as ENQA and EQAVET recommendations for accreditation and quality enhancement. DAhoy brought positive and long-lasting effects on the participating organisations and their staff and learners, and on other regional, national and European Institutions as formalised in its 8 target groups. It outputs 3 guides, toolkits, a Youtube channel with 10 videos produced by the partnership, 14 publications and conference presentations. The guides include

1. a taxonomy of decision skills requirements and unified learning outcomes syllabus (report O1);
2. innovative models and kits for Decision skill training, transferable in many educational fields (report O2);
3. a D-Skill Framework, continuously integrative for programmes renewal (this O3 report).

How to prepare HE and VET students for a VUCA-world?

The recent 2020 COVID-19 (coronavirus) will change the future of work and students employability and careers. This global VUCA crisis and incident management recall the profound need for enhanced decision-making skills, as categorised by the DAhoy project, i.e. constant vigilance, discernment & judgement, react to face VUCAlity, dare with courage, take responsibility for decision-making and learn from experience. The knowledge and skills that our graduates will have to bring tomorrow to actively contribute to the post-Covid-19 period will be decisive.

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The world is changing at a rapid pace, and is becoming increasingly Volatile, Uncertain, Complex, and Ambiguous (VUCA). Worldwide, there is a growing concern about responsibility for Decision Makers. Decision is not only about knowledge, it's also a question of skills. Now education is about helping students develop a reliable compass and the navigation skills to find their way through an increasingly uncertain, volatile and ambiguous world. Embedding decision skills into a curriculum is essential for future professionals to be ready for unforeseen VUCA situations. Business and industry sectors have recognised a growing need to enhance skills that let them deal with VUCA situations, i.e. with unexpected scenarios and events such as financial crisis, unstable software systems and natural disasters. Universities may want to consider instilling some VUCA aspects into their programmes, aiming to prepare students to confront unexpected situations in the context of decision-making and leadership and for facing a rapidly changing world.



How can we approach and overcome the educational challenges to prepare graduates for their future responsibilities? In the curriculum, when and how it is best to develop a student's ability to discern; and make good decisions at right times in VUCA environments?

Students must capture the multiplicity of contextual factors influencing individual and / or collective DM processes. The VUCA world is volatile, uncertain, complex and ambiguous. Teaching decision-making under such conditions cannot be based exclusively on mathematical models. A large part of future work activities will be to take decisions in uncertain and ambiguous context (related to scientific, technical but also economical or organisational choices). The general objective of teaching the 'new normal' must equally be based on social sciences and to go beyond common sense explanations of decision-making processes. Decision-making skills are transversal and can be enriched by a multiplicity and variety of experiential learning situations.

In most of the worldwide countries, the 2020 COVID-19 will change the future of work and students' employability and careers. The learners of today are the decision makers of tomorrow. It is time to think about the imminent future of higher and VET education. DAhoy members strongly

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believe in the mission of DAHoy to forward the training of engineers, but also STEM and business learners to include or further extend the skills of uncertainty management which is the foundation for decision analysis. Other fields are, of course, considered for transferability. The future will be full of surprises, maybe more than before. Many of the events, technical developments, social circumstances we now take for granted would have been considered impossible only a few years back. The jobs that are in top demand today did not exist a few years ago. We are preparing skilled students for jobs that do not exist today, educating future decision makers to solve problems we do not know yet and to let them manage their professional career path in the long term. These competences will be transferable.

Report structure

This report is delivered within the context of the *DecisionShip Ahoy!* Project, 2017–2020. DAHoy organised 6 mobilities (three for teachers and staff in 2018 and three for the students in 2019). During these mobilities (3*3 days in 2018, 5*3 days in 2019, thus 24 days) participants experience about 30 different situations of learning in the form of capsules (short learning activity from 2 hours to 2 days max). These 2018-19 DAHoy experiences, from the design to operation and evaluation phases of the capsules at micro level (single course), were the source to define educational frames and reflect on their curricular integration at meso to macro levels (i.e. single but large programme or set of programmes in a university) thanks to the analysis conducted in DAHoy with faculty, educators, teachers and students all along the project.

This third DAHoy report, for programme leaders, is structured as follows:

- The first section presents the 6 reference models, as part of the DAHoy framework;
- The second section first presents the DAHoy integration process by clarifying the DAHoy-style capsule concept, and transformation support for decision-making skills integration in curricula. The DAHoy integration is then defined with a flexible process, including 18 activities structured in 4 phases. In the appendix, two examples of course' creation or transformation are overviewed: (1) a challenging 2 day course, 'as a DAHoy capsule realigned to challenge students with uncertainty in a VUCA situation, and (2) a restructuring of a Career Decision-making course for seniors, reorganised with 7 capsules all along a 3-year curricula;
- The third section helps to support continuous improvements in the HE and VET sectors for transversal Decision skills, where criteria are parts of the proposed reference models, possibly associated with measurement models for interpreting the data and showing evidence of integration, as part of process capability;
- Conclusion presents future work and post-COVID-19 reflection and perspectives. For the COVID-19, a reflection on D-Skills during the beginning of crisis management at a partner university is proposed in the Appendix.

DAHoy members recommend more emphasis on the newly required transversal skills (as decision-making), on flexible curriculum structure, and career concerns. This DAHoy O3 report

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may guide university leaders and STEM programme managers, so as accreditation and quality assurance bodies, in revising measures and processes to prepare for the anticipated future of higher and VET education, post-COVID-19.



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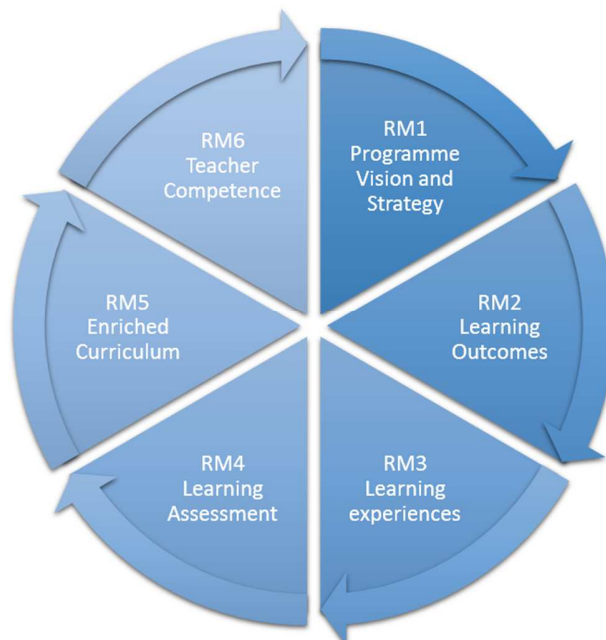
DAhoy reference models

Context

The six DAhoy Reference Models provide Higher Education (HE) and Vocational Education and Training (VET) schools and institutes with the fundamentals set in the context of teaching and learning decision skills in context of the agile and ambiguous business environment students face post graduation. The educational framework described in this text is founded on the principles of volatility, uncertainty, complexity and ambiguity (VUCA) facing managers and leaders in the modern society. The 6 RMs can support HE and VET institutions to adapt their current framework of their curricular planning and outcome-based assessment.

The 6 RMs are core reference models are interconnected entities each describing a major concern to consider for various stakeholders with various responsibilities in educational programme design and development and quality assurance. The 6RMs are

- RM1 VUCA D-Skills Programme Vision and Strategy
- RM2 VUCA D-Skills Learning Outcomes
- RM3 VUCA D-Skills Learning experiences
- RM4 VUCA D-Skills Learning Assessment
- RM5 VUCA D-Skills Enriched Curriculum
- RM6 VUCA D-Skills Teacher Competence



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Editing guidelines for DAHoy Reference Models

The guidelines for DAHoy reference models are inspired by design partners as found in software engineering. According to www.sourcemaking.com, a design pattern is a general repeatable solution to a commonly occurring problem in software design. A design pattern isn't a finished design that can be transformed directly into the code. It is a description or template for how to solve a problem that can be used in many different situations. Design patterns can speed the development process by providing tested, proven development paradigms.

The DAHoy guidelines are also partly based on guidelines from the ISO organisation (see i.e. <https://www.iso.org/drafting-standards.html>) and the CDIO standards (see i.e. <http://www.cdio.org/content/cdio-standard-21>). The purpose is to provide a guide to remember when editing a RM document. It must be assured that a common understanding on purpose and policy exists among the writers so the results of the DAHoy project can be communicated effectively to the stakeholders.

The systemic view of reference models

It was shown in the CDIO or QAEMP self-assessment models that key features, as reference models, are to investigate to enhance programmes at a systemic level, even more in the scope of transversal skills for the best of learner development and global educational quality. CDIO specifies a reference which includes 12 standards, with guidelines, rationales, and good practises, for engineering education at B.Sc. level. These standards range from the aims, the learning outcomes, the pedagogical styles, student workspaces, student assessment, QA, etc. but from a global perspective, not specifically decision skills oriented.

The QAEMP Erasmus+ KA2 project reached its end in summer 2016. It offers a set of 27 criteria to assess an educational programme and prepare for a quality enhancement loop by pairing institutions. Decision skills are not specifically referenced. In another context, at the European level, to measure sustainability and social responsibility performance of HEI or programmes, the QUESTE-SI project proposed to rate dimensions and progress in terms of objectives and indicators which permits comparing several institutional units, rather than ranking them. As shown in the context of QUESTE-SI, a fair evaluation of Social Responsibility and Sustainability Education (SRSE) should not be limited to teaching and learning methods or curricular content.

A quality enhancement approach to evaluation is to be multidimensional to reach developmental emphasis. A set of knowledge skills, especially transversal, cannot be developed in a vacuum, it depends upon parallel efforts in several dimensions, as the Institution, Department, or Faculty.

The CDIO worldwide initiative intends to improve the quality of engineering education worldwide. The CDIO approach embodies core components supporting the quality assurance of a

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programme developing its operations, among them the CDIO Syllabus defining the programme's goals and student learning outcomes. Internationally, the CDIO approach started in 2000 when a group of engineering educators identified the gap between the working life expectations and engineering education (at MIT in Boston first). A need to create a new vision and concept for undergraduate education was recognised and thus the CDIO approach was developed with input from various stakeholders such as academics, industry, engineers and students. The CDIO approach is adaptable to all engineering schools and higher education institutes, also graduate education. There are more than 125 institutions as members. The CDIO collaborators, as the participating institutes are called, come from all parts of the world. The CDIO Initiative member schools are now divided into regions, including Europe (which includes Russia and the northern part of Africa).

The purpose of DAhoy RMs

It is useful to heed the purpose of RMs. The following is adapted from Wikipedia sources for the purpose of RMs. There are many uses for a reference model. One use is to create standards to define the desired and how these qualities are obtained by interconnections of different parts of the model. A standard is also a benchmark for maturity. Another use of a reference model is to educate. Using a reference model, leaders in HE and VET schools can be helped to break down a large problem space into smaller problems that can be understood, tackled, and refined. Educational institutions who are new to the challenges of D-Skills training, the VUCA style can quickly guide them to understand what the different challenges are, and can focus on the change processes and continuous improvement. A third use of a reference model is to improve communication between people. A reference model breaks up a problem into entities, or "things that exist all by themselves". This is often an explicit recognition of concepts that many people already share, but when created in an explicit manner, a reference model is useful by defining how these concepts differ from, and relate to, one another. This improves communication between individuals involved in using these concepts. A fourth use of a reference model is to create clear roles and responsibilities. By creating a model of entities and their relationships, an organisation can dedicate individuals or teams, making them responsible for solving a problem that concerns a specific set of entities. For example, if a reference model describes a set of measurements needed to create a balanced scorecard, then each measurement can be assigned to a leader. That allows a senior manager to hold each of their team members responsible for producing high-quality results. A fifth use of a reference model is to allow the comparison of different things. By breaking up a problem space into basic concepts, a reference model can be used to examine different strategies and tactics to solve a problem.

The structure of a RM document

Introduction

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The introduction is optional but should describe the content of the RM section and give information on why the section is needed as well as background information if applicable.

Goal

A goal describes what a HE and VET institute edifying D-Skills should expect or hope to accomplish strategically, tactically and/or operationally over a period by the respective RM. The goal of the RM section must be clear and well defined and correlate to the maturity rubric for the respective RM.

Stakeholders

In education, the term stakeholder typically refers to anyone who is invested in the welfare and success of a school and its students, including administrators, teachers, staff members, students, parents, families, community members, local business leaders, and elected officials such as school board members, city councillors, and state representatives. Stakeholders may also be other collective entities. In a word, stakeholders have a “stake” in the HE or VET school and its students, meaning that they have personal, professional, civic, or financial interest or concern. Each section should identify the main stakeholders (e.g. student, teacher, faculty, school admin, QA manager, programme dean), the respective RM concerns, and the role of the stakeholder.

Stakeholder definition	The role of the RM

Description

The description should explain the scope of the respective RM i.e. it should describe what the corresponding RM section does. For example, this RM ...

- specifies ...
- establishes ...
- gives guidelines for ...
- defines terms ...

The description/scope should be written as a series of statements of fact. However, requirements, recommendations or permission should not be included in the Scope. This section should also include the limits and constraints if any. What is omitted in this section? For example, this RM does not address...

Rationale / justification

Rationale describes the underlying basis for the RM and should list exactly what is proposed for the HE and VET institute to do to use/deploy the corresponding RM for edifying D-Skills according to the DAHoy way and in correlation to the scope of the RM and the maturity rubric. Good practices and examples can be provided.

Links to other RMs

Describes if and how the respective RM connects to other RM and why this is the case.

RM1: VUCA D-Skills Programme Vision and Strategy

A VUCA based teaching and learning D-Skills programme is based on the principle that making right decisions at the right time is an appropriate context for HE and VET education. Decision skills in the context of VUCA should be enhanced via courses and training that in general terms should be balanced between seven skill sets accounted for i.e. in RM2 and RM3. The D-Skills should be developed by reference to the following academic fields.

- *Math-based decision-making skills:* This skill set describes the ability to use a normative approach e.g. by applying mathematical and logical rules to solve a decision problem.
- *Human and social based decision-making skills:* Arguably, the biggest obstacle for rationality is how the mind works when people make decisions. E.g., mathematical approaches might work under circumstances when the decision makers have enough time to contemplate the decision problem. But many conditions of pressure and stress deprive the people of in-depth analysis and make them vulnerable to errors of judgement. These conditions can also constrain the abilities of working together towards a quick solution. Applying a mathematical model is done with assumptions ... that a strong VUCA situation or crisis can make it obsolete ... and you have to know how to see that. Questioning assumptions, values, estimates ... because the situation is changing. These are humans who build mathematical models.
- *Personal and career based decision-making skills:* Several influential EU bodies regard career management skills as competencies, which help individuals to identify their existing skills, develop career-learning goals and take action to enhance their careers.

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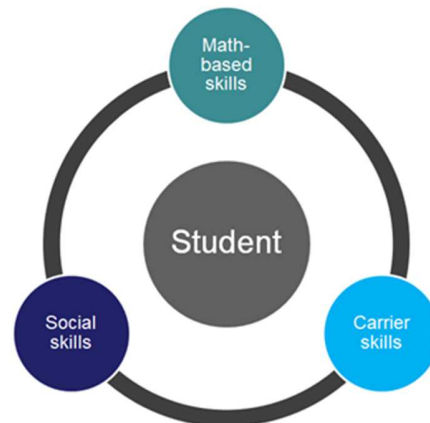


Figure. The interconnected skillsets of DAHoy academic perimeter.

Goal

The HE and VET institutions edifying VUCA based D-Skills must commit themselves by stating their mission and beliefs. Context is stated by carefully defining the:

1. Role & intention: a short description of the reasons to disseminate knowledge on D-Skills in the VUCA environment in the educational institute.
2. Mission: a short description of the values of the educational principles of D-Skills in the VUCA environment.
3. Core activities: a short description of the core activities to consolidate the mission statement. A typical core activity is emphasising interdisciplinary work, ties to industry, innovation, etc.

These three topics form the strategic foundation for the curriculum development and the set of parameters to consider when forming a strategy and policy for teaching decision analysis based on the VUCA concept in Higher Education (HE) and Vocational Education and Training (VET). Parameters in this context are the characteristics that can help in defining or classifying a strategy. That is, a parameter is an element of a system that is useful, or critical, when identifying and implementing the educational framework required.

Description

The leading platform for responsible management and leadership education is the PRME (the Principles for Responsible Management Education) launched in Geneva in 2007 as a community for curriculum development and student engagement. The PRME framework is inspired by the UN goals for Sustainable Development Goals.

The PRME's six principles are:

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1. Purpose: We will develop the capabilities of students to be future generators of sustainable value for business and society at large and to work for an inclusive and sustainable global economy
2. Value: We will incorporate into our academic activities and curricula the values of global social responsibility as portrayed in international initiatives such as the United Nations Global Compact
3. Method: We will create educational frameworks, materials, processes, and environments that enable effective learning experiences for responsible leadership.
4. Research: We will engage in conceptual and empirical research that advances in our understanding of the role, dynamics, and impact of corporations in the creation of sustainable social, environmental, and economic value.
5. Partnership: We will interact with managers of business corporations to extend our knowledge of their challenges in meeting social and environmental responsibilities and to jointly explore effective approaches to meeting these challenges.
6. Dialogue: We will facilitate and support dialogue and debate among educators, students, business, government, consumers, media, civil society organisations and other interested groups and stakeholders on critical issues related to global responsibility and sustainability.

These principles should be echoed in the deployment of VUCA based D-Skills training.

Stakeholders

In education, the term stakeholder typically refers to anyone who is invested in the welfare and success of a school and its students, including administrators, teachers, staff members, students, parents, families, community members, local business leaders, and elected officials such as school board members, city councillors, and state representatives.

Stakeholders may also be other collective entities. In a word, stakeholders have a “stake” in the HE or VET school and its students, meaning that they have personal, professional, civic, or financial interest or concern.

Stakeholder definition	The role of the RM
Students	Interest in participating in learning D-Skills in the VUCA environment
Teachers	Interest in teaching D-Skills in the VUCA environment
Staff members	Determination to teach and develop D-Skills teaching in the VUCA environment

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School Admin	Determination to implement strategy to consolidate the teaching
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Rationale

The objective of the academic platform of the DAhoy project is essential to develop good decision makers that can create value for society, employers and themselves by possessing a toolkit of knowledge, skills and competences at graduation. The educational institutes should set specific learning outcomes and specific key attributes both in technical and professional areas. Furthermore, there should be accreditation criteria enabling accreditation bodies to identify the programme outcomes in terms of the VUCA skillsets.

Implementing a strategy requires a change management process as introducing a new approach cannot be seen as an isolated process. Everything in an organisation is connected, and changing one piece can impact another. This is why implementing the new strategy is only likely to be successful if it considers all of those interconnected pieces.

This is where Leavitt's Diamond is useful. Designed by Harold J. Leavitt in 1965, the model is a framework for understanding the connection between the key factors in an organisation, and for building an integrated change strategy. It may be noted that other change management models are available e.g. the Congruence Model, the Burke-Litwin Model and the McKinsey 7Ss.

Leavitt's Diamond is based on the principle that an organisation has four major components that are all interdependent:

1. Tasks
2. People
3. Structure
4. Technology

Later the model was revised to include 'Change Leader', the person responsible for seeing the model through and implement changes.

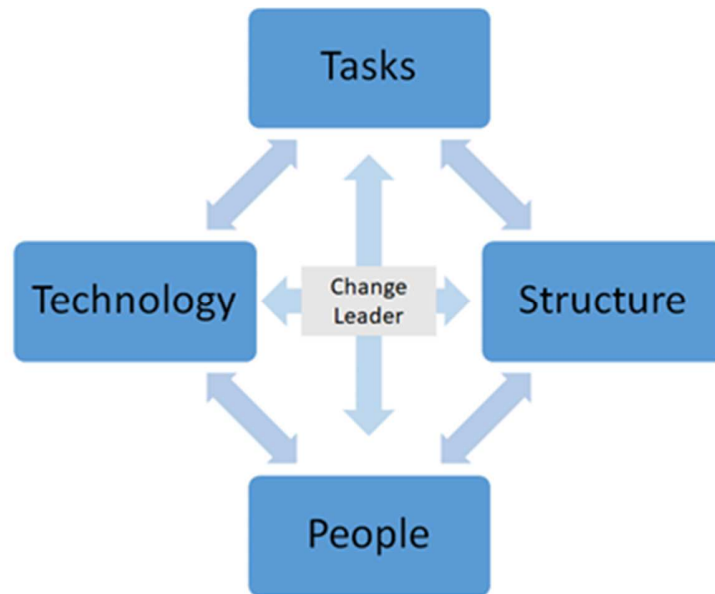


Figure. Leavitt's change management model, often called Leavitt's-diamond.

Any type of change or redesign in one component will affect the other three. According to this approach, before you bring about change in any one of the four components, you should evaluate the impact on the other three components. To implement change successfully, the leader must find the right balance between all of them.

In the context of the DAhoy programme or how to teach and train for decision-making in the VUCA environment, the Leavitt's model has been used with success e.g. by developing a CDIO based engineering curriculum at DTU (Denmark Technical University) by Jesper Brun and Klaus Kjærgaard.

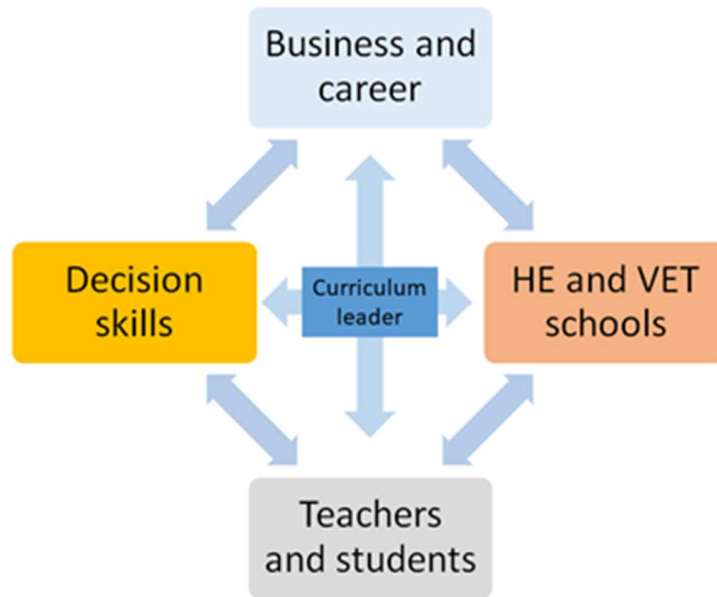


Figure. The Leavitt diamond in the context of DAHoy.

The Leavitt approach is considered in the context of DAHoy 6 Reference Models the following definitions can be used:

- The “Technology” is the scientific parameters that constrain what is called Decision skills in DAHoy. Decision skills are firstly the seven skill qualities that the training should provide and secondly; three knowledge areas the programme is based on (see Reference Models 1 and 3).
- The “Tasks” are firstly serving the business community with students that are able to participate in teams, preferably as leaders, to facilitate a decision-making process under stressful and uncertain conditions and secondly; to provide students with tools that enhance their chances of a fruitful career. This is the challenge of deciding which kind of work force the higher & VET schools are developing for the future. See Reference Model 2 and 3.
- The “Structure” is the environment of HE and VET schools. Several challenges are facing schools in our times to communicate the knowledge and the application of knowledge as society progresses towards the future. It is doubtful that the current structure is the one applicable for VUCA teaching. The structure and policies of HE and VET schools are also different as these types of schools serve different strategic purposes. The curriculum should therefore strike a balance between firstly the type of school and secondly what type of training is needed. Reference models 1, 2, 5 and 6 are all instrumental in the HE and VET school environment.
- The “People” are the students and the teachers. The environment must provide innovative and exciting learning for the students and challenging and stimulating teaching for the teachers. Values and ethics are also important parts of decision-making and must be

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embedded in the learning approach. Additionally, the suitable courses, number of students, training of teachers, applicable teaching methods, facilities, etc. are also important.

Curriculum leader is responsible for implementing the changes. The main issue for the curriculum leader is that it is impossible to look at the changes in isolation. If you change one element of the model, it will impact others. This demanding role requires authority, leadership and management. This role has relevance to all the Reference models as the curriculum leader is de facto the project leader. The Curriculum Leader role may be carried out by a single person or a team.

To use Leavitt's change management approach in DAhoy a two-step process is recommended:

Leavitt's change Step One: Segmentation of the tasks

Business and career (Tasks): identify the main tasks, including both routine and key tasks required for the change. This may differ between schools as the students aim for different careers. The main aim is to realise and manifest which decision-making competences the students should master at graduation. Some relevant questions are:

1. What kind of decision makers does the industry need?
2. How do the teachers prepare the students for a career as decision makers?
3. What is necessary to do within the school to provide the needed learning experience?
4. Etc.

Teachers and students (People): Teachers and students are the key consideration in any change initiative of the curriculum. If they are not onboard, changes are impossible. Some relevant questions are:

1. What are the beliefs, attitudes, and behaviours of teachers and students?
2. What is their response to the proposed change?
3. What are their current skill levels?
4. What are they trained to do? Currently?
5. What are the rewards that motivate them?
6. What is their work culture?
7. Etc.

Structure: HE and VET schools serve different students and different industrial needs. Higher education (HE) is generally provided by universities and by other higher education institutions while Vocational Education and Training (VET) qualifications have been developed with the specific goal of preparing students with skills for work. HE schools might have a strong academic focus but VET a strong practical focus. This requires diverse organisational structures and diverse curricula.

Some relevant questions are:

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1. What is the hierarchy in your school?
2. Where is the control at each organisational level?
3. How are duties divided?
4. What is the work flow?
5. How will maturity and advances be managed?
6. What is the communication flow?
7. How is the VUCA skill set grid applied?
8. Etc.

Decision skills (Technology): Identify the decision skills the HE and VET schools decide to disseminate to the students based on the academic boundaries of decision analysis as defined in the DAhoy scope. This also includes key equipment and processes that enable and support the teaching/learning functions, including computer systems, essential software, devices – anything that enables decision skills of the students. This also includes the training of teachers incorporating seminars and training materials.

Some relevant questions are:

1. What theoretical background is available?
2. What facilities are in place for experiential learning?
3. How do current courses in decision-making fit VUCA teaching?
4. What training is needed for teachers?
5. Etc.

Leavitt's change Step Two: The Impact of Change

Determine how the primary change will impact each of the four components. As can be seen in the reference models teaching decision-making in the VUCA environment requires experiential learning. Students will learn decision-making by using the classroom as a platform for explaining the theory of decision-making. The knowledge acquired within the classroom is then manifested by solving decision problems outside the classroom.

Good Practices/Examples

An example of good practice is to have a plan in place to address the VUCA criteria for teaching and VUCA based activities are in function as part of the teaching schedule and the syllabus. There should be at least one VUCA advocate among the faculty. Better still to have VUCA teaching consolidated in the syllabus and among faculty members and a review process for continuous improvements in place.

Links to other RMs

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RM	Little	Some	Significant	Explanation
RM1				NA
RM2		X		Learning outcomes are tactical arrangements of the mission and strategies laid out in context of RM1
RM3		X		Learning experiences are tactical and operational arrangements of the mission and strategies laid out in context of RM1
RM4		X		Learning assessments are tactical and operational arrangements of the mission and strategies laid out in context of RM1
RM5			X	Mission, strategies and change management processes of RM1 should be mirrored in the curriculum integration
RM6			X	Mission, strategies and change management processes of RM1 should be mirrored in the faculty competencies

RM2: VUCA D-Skills Learning Outcomes

The DAHoy project aims to provide a set of decision skills statements (in a VUCA environment) and to create a common basis of skills that link to National Qualifications Frameworks (NQFs) and other European Tools. This reference model is inspired by the Dublin descriptors, the European Qualification Framework, recalls at level 5 “competence to exercise management and supervision in contexts of work or study activities where there is unpredictable change”; and at level 6 “to manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts”.

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Objectives

Following analysis of the NQFs of the project partners and the EQF to ascertain the extent to which decision skills are included in level descriptors there was a recognition that the disparity between the level descriptors in terms of inclusion of decision skills meant that a single set of complementary statements addressing decision skills would not be possible. Thus, the component to formally produce a single set of statements to which could be aligned to the levels of a range of NQFs and to the EQF was not possible. The objective was adjusted to create a set of decision skills statements that would aid curriculum developers to include such statements in learning outcomes and to enable them to analyse and/or develop associated activities. The alignment with NQFs is still a possible future activity by individual countries.

The objective therefore is to promote reference to decision skills and/or VUCA capabilities in programme outcomes or in graduate profiles.

The RM2 outlines the process that has been suggested by which decision skills and/or VUCA capabilities can be identified and/or developed in programme outcomes and activities and how the alignment of the statements to a National Qualifications Framework (NQF) could be considered for national recognition of skills by national NQF coordination points.

Stakeholders

Stakeholder	The Role of the RM
Curriculum Developer	Analysis of programmes learning outcomes against the D-Skills
Curriculum Developer/Credit Rating Body (Scotland)	Analysis of programmes against the SCQF aligned decision skills statements

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NQF Owners/Coordination Points	Analysis of EQF level descriptors in relation to the inclusion of decision skills or VUCA situations
--------------------------------	------------------------------------------------------------------------------------------------------

Description

To meet these objectives of including skills related to decision-making, a set of the decision-making competencies (known as D-Skills) was developed. This set of skills is not aligned to any national qualifications framework or any national or European level descriptors.

A set of statements aligned to the SCQF (Scotland's NQF) and complementary to the existing SCQF level descriptors and Employer Toolkit was explored and developed and these are available within O2/A5 for practitioners based in Scotland or those wishing to align to the Scottish framework (see below)

Rationale

A sample of NQFs and the EQF have been examined and an analysis provided where decision skills and/or VUCA situations were referred to in the level descriptors. The analysis showed that the SCQF descriptors included a high quantity of reference to decision-making skills and VUCA situations. A set of decision skills statements was developed taking cognisance of the level descriptors for SCQF (Scotland's National Qualifications Framework) levels 6–11 (EQF levels 4–7). The SCQF descriptors for the levels considered can be found on the SCQF website at <https://scqf.org.uk/media/1123/scqf-level-descriptors-web-aug-2015.pdf>. It has been identified where there are already aspects of decision skills within the characteristics at each level. In addition reference was also made to the contextualised statements contained in the SCQF Employer Levelling Tool¹ which uses the SCQF level descriptors as its base to create a set of person specifications for each level. This resulted in a set of statements which were complementary to the existing Framework level descriptors and which can be used by practitioners in Scotland as further exemplification and a tool to identify the appropriate level of decision skills to include when designing programmes at SCQF level 6–11 (EQF 4–7).

These statements have been peer reviewed by a member of staff at a Scottish HEI and also by colleagues within the SCQF Partnership (the NCP for SCQF).

- Broadly Comparable to SCQF Level 6 (EQF 4): Express, organise, collate and control information and identify safe ways of working in order to make a decision;
- Broadly Comparable to SCQF Level 7 (EQF 5): Develop decisions by consulting external sources and working under guidance, apprise safe ways of working;

¹ <https://scqf.org.uk/media/1117/employer-levelling-tool-web-mar-2017.pdf>

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- Broadly Comparable to SCQF Level 8 (EQF 5): Analyse, revise, delegate and control tasks and situations, working independently to apply rules-based decision-making in familiar, conflicting situations;
- Broadly Comparable to SCQF Level 9 (EQF 6): Analyse situations & apply rules-based decision-making to anticipate and weigh impacts in unfamiliar situations that include a degree of unpredictability. Take responsibility for decisions as head of a team through consulting external sources;
- Broadly Comparable to SCQF Level 10 (EQF 6): Analyse situations & apply rules-based decision-making in conflicting, unknown situations with a degree of unpredictability to anticipate and weigh impacts. To take accountability for a team and be able to reflect and evaluate decisions:
- Broadly Comparable to SCQF Level 11 (EQF 7): Analyse, apply and implement innovative solutions to Volatile, Uncertain, Complex and Ambiguous (VUCA) situations to make decisions.

However, as the existing level of reference to decision skills and/or VUCA varies across the level descriptors of NQFs this makes it difficult to produce a set of statements that would have also appropriately complement the other NQFs. To use the set proposed for Scotland above resulted in what looked like gaps to other partners in the statements.

As a result, a more generic set of decision skills statements, the D-Skills, was produced which had no link to any specific NQF and were not aligned or compared to levels of learning but rather were organised by topic and then graded by low, medium and high.

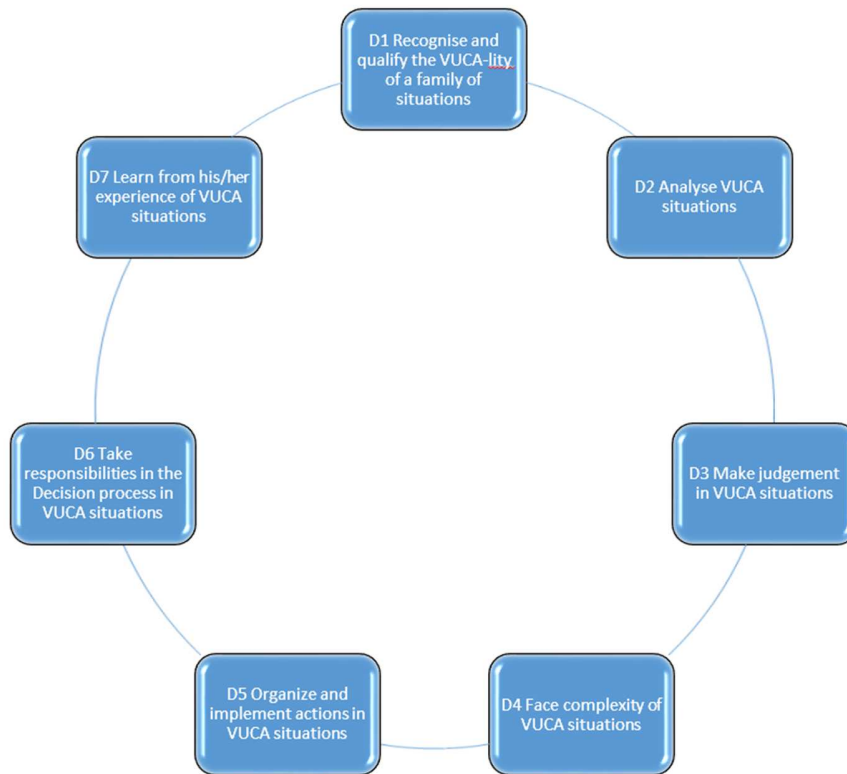


- D1 Recognise and qualify the VUCA-lity of a family of situations
- D2 Analyse VUCA situations
- D3 Make judgement in VUCA situations
- D4 Face complexity of VUCA situations
- D5 Organize and implement actions in VUCA situations
- D6 Take responsibilities in the Decision process in VUCA situations
- D7 Learn from his/her experience of VUCA situations

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These statements are then used as the basis for the VUCA assessment grid outlined in RM3 a tool which will allow curriculum developers and practitioners to analyse and identify the opportunities for learners to develop decision skills in learning and teaching activities and to identify appropriate associated assessment tools.

Links to other RMs

RM	Little	Some	Significant	Explanation
RM1	X			RM1 underpins the work in RM2 to develop decision skills statements
RM3			X	RM2 underpins the work of RM3 work on D-Skills and VUCA meters
RM4		X		RM2 underpins the work in RM3 which in turn is the tools and techniques tested in RM4

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RM5	X			RM5 further explores external links from the work in RM2
RM6	X			

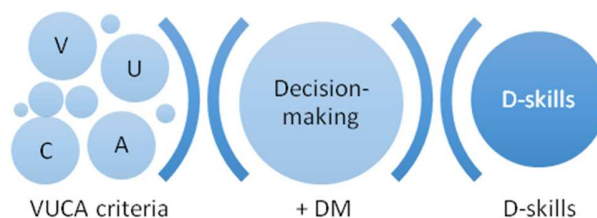
RM3: VUCA D-Skills Learning Experiences

Objectives

To meet these objectives of developing skills related to decision-making processes, it was necessary to identify the decision-making competencies within the three components (mathematical-social-career) dealing with decision-making in a VUCA environment. In the DAhoy spirit, the implementation of the D-Skills involves first identification of training (T&L) in the form of experiential activities (e.g. PjBL, PBL, active learning, outdoor camps or experiences, serious game, simulation) or more theoretical training (courses, book reading, etc.) dealing with decision-making based on the 4 VUCA criteria.

Description

The formats of pedagogical activities, with capsules, are of a different nature: the duration varies from 2-hour sessions to 20 hours activities and are to be integrated in more large scale curricula on the theme of decision-making or for transversal skill reinforcement. Thus, from these study components, the objective is to highlight decision-making skills and to test these D-Skills in a specific environment characterised by the VUCA training activities. The influence of the environment, the importance of the situation, the team composition (experts, novice, etc.) supporting the decision maker and the type of organisation in which they operate can all have an influence on their decisions.



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Figure. Concepts for pedagogical styles.

These activities are constituted by experiential or active courses, internships, seminars, PBL, PjBL, simulations, project follow-up with students but also coaching sessions for student career or serious games. The range is very wide, it offers the opportunity to provide a variety of activities that constitute a breeding repertory from which innovative T&L can emerge.

For each activity identified by the DAHoy project partners, it is required specify and to assess the level of magnitude of the four VUCA criteria.

Title of the activity:

D-skills: D3

VUCA levels :

Non representati	Low level	Medium level	High level
	V		
		U	
			C
		A	

Fig. A VUCA grid extract for assessing VUCA'ility of activity, examples of D3 DAHoy skills.

Methods / Rationale

As a learning experience component, a learning capsule is defined as a course offer of 2 hours to 20 hours, relying on active and/or experiential pedagogy to reinforce dedicated skills aside knowledge for VUCA situations. A learning capsule is specific to an institution but can take inspiration from DAHoy T&L examples. The timeframe figures were picked according to the duration of the various activities the DAHoy project trialled. This is mainly a guideline but validated by the partners in their own contexts. The level of magnitude of the VUCA criteria and the operational aspect are specified.

The training periods at the project partners, 3 Joint Staff Training Events (JSTE) for faculty staff in year 1 at City of Glasgow College (COCG), Reykjavik University (RU) and Ecole Navale (EN) and 3 Teaching & Learning weeks for STEM students (T&L) in year 2 at IMT Atlantique Graduate School of Engineering (IMTA), Ecole Navale (EN) and Reykjavik University (RU), allowed the most relevant activities to be selected in relation to the VUCA criteria (JSTEs and TLs reports are available via the official DAHoy website).

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These simulations also made it possible to determine the operating mode of the activities, the level of the target audience, the order of the sequences to be followed, and to specify the pedagogical objectives related to decision-making. This was also an opportunity to reflect carefully on the definition of the VUCA criteria in order to assess their level of magnitude in relation to the activity concerned.

Indicators of results

Indications are to be initiated with questions such as: what are the theories of VUCALity? What are the learner's motivational factors? What are the so called learning outcomes? How to characterise the VUCALity of learning situations to continuously reinforce learner proficiency throughout a curriculum?

As experienced during the Dahoy project, a selection process of activities could be in place, with an iterative assessment model. One way in which students in universities are trained in decision-making under VUCA-like conditions is through experiential learning (Dewey, 1939; Kolb, 1984). An example of this, DAHoy project results can be used to better prepare students for an unpredictable future. In DAHoy, decision skills statements and related outcomes were developed in the context of design-based research (DBR) (Rouvrais, Gaultier Le Bris, and Stewart, 2018). DBR focuses on real educational situations (Anderson & Shattuck, 2012), which are potentially more complex than simulated environments. The DBR took into account several variables: knowledge, skills and competencies, motivational factors, variables of the learning situations and environmental factors. The DAHoy DBR commenced with project partners purposefully taking into account the Higher Reliability Organisations (HRO) models and results of the actionist movements (Weick, 2001), as well as the complexity aspect of Journé (1999). Operational variables were examined, with a flexible revision of the design (Campbell et al., 1966), related to the limits identified in some previous experiments that we had from the French Naval Academy (Ecole Navale). The selected theoretical framework allowed for more methodological robustness. In a second DBR iteration, decision-making statements are selected and used for learning activity redesign and student assessments. Based on teaching & learning activities, a flexible process of analysis; design; evaluation and revision, as well as theoretical contributions on curriculum integration of decision-making skills is in place.

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Figure. Overview of the work process.

Good practices / examples

A training institution, external to the DAhoy project, can choose an activity, or some of its capsules, among the 29 activities initially identified and experienced (T&L) and among the 15 specified activities (all available via the DAhoy website), that could be appropriated for external use within European higher education institutions. As an example, COCG has chosen among the 3 activities a simulator-based activity that is intended for future sailors; however, these skills are transferable to other educational settings because sailing on a bridge (scale 1 of a ship's bridge) is a real exercise that tests decision-making where VUCA criteria are put to the test. It is also possible to vary these criteria because it is a simulator (e.g. to increase the level of complexity).

Resources

15 activities were selected and proposed in DAhoy for transferability some others were implemented. Via the DAhoy website, all these selected courses, inc. capsules, qualify and quantify resources according to material, time, staff, infrastructure. As an example, the cost of a simulator and the experienced staff to operate it are possible obstacles. DAhoy have deliberately chosen activities whose "barriers to entry" are lower.

- 1) COGC in relation to SCQF has selected 3 activities out of the 5 initially proposed (3 from COGC, 2 from SCQF)
- 2) IMTA has identified 5 out of its 11 activities:
 - a) Reliability and Decision Making via Inshore Cruising, aka. "all in the same Decision Ship" (32h in 3 capsules), available on the DAHoy YouTube channel
 - b) Career Integration and orientation Passport (25h in 3 capsules)
 - c) Co-orientation (22h in 6 capsules)
 - d) Strengths characters with Job casino (6h in 3 capsule)
 - e) Strategic decision-making in VUCA Situation (63h in 8 capsules)
- 3) EN selected 3 out of 9 activities
- 4) RU has added one activity so 3 in total
- 5) FUEIB has selected 1 out of 2 activities initially proposed.

Links to other RM

RM	Little	Some	Significant	Explanation
RM1	X			RM3 includes elements of contexts and main goals of RM1
RM2			X	RM3 is related to RM2's expected outcomes on D-Skills and VUCALity requirements.
RM3				NA
RM4		X		RM3 introduces a basis for constructive alignment principles, between learning outcomes (RM2), courses (RM3) and learner assessment (RM4)
RM5			X	T&L activities in line with DAHoy pedagogical styles for VUCA transversal skills are the core components of DAHoy capsules to integrate at programme level
RM6		X		Faculty and teachers are to be better trained to VUCA situations, to enhance their skills for, teaching but also managing the quality of educational programmes.

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RM4: VUCA D-Skills Learning Assessment

Goal

The objective is to promote decision skills and VUCA capabilities in programmes delivered at HE and VET institutions. The RM4 considers the assessments which could be utilised in determining the level of VUCA skill set the student will achieve having completed the activities/module.

Stakeholders

Stakeholder definition	The role of the RM
Awarding Body	Determine summative assessment strategy
Curriculum designers	Adding assessment into the design of each course/module
Teachers	Implementing assessments into course
Admin support	Recording summative assessments

Description

This RM4 specifies the forms of assessment which can be used in determining achievement. There are two forms of assessment which can be used to ensure the students' comprehension and understanding: formative and summative. In all activities it should be assured that they are valid, reliable, practicable, impartial and access to be fair. This RM does not address setting levels of achievement and is not exclusive.

During the teaching and learning events the method is to be mainly formative, 'generate feedback on performance to improve and accelerate learning' Sadler (1998: p77-84). This included but was not limited to, listening and facilitating discussions, quizzes and presentations. There is value in each of these methods as described below:

- *Discussions* - valid and authentic as it allows students to talk about the subject covered, from this it is also clear to see what the learners have understood regarding the concept or areas that need clarity. Furthermore, this gives instant feedback.
- *Quizzes* - all questions should be linked to course content to establish the decision skills. These quizzes allow scores to be recorded, check for improvement and discuss this with the students.

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- *Presentations* - used to check understanding and development. After undertaking presentations, the students were given constructive oral feedback. This type of assessment truly aids learners as they are always aware of their progress.

Rationale

To comply with formal qualification models then summative assessment is required. Summative assessment is generally assessed in two primary ways, a final closed book exam or written report. However in some systems summative assessment can also take many other forms such as observations of practical performances, as was operated in several DAhoy experiential teaching & learning activities outdoor (sea, forest), oral defence with portfolios. In all cases it should be assured that, again, the ‘Decision Skills’ were met and were valid (inc. criteria and observable proofs). For all options a clear marking scheme must be followed, to ensure reliability.

A DAhoy capsule can be credited. If the capsule is greater than 10 hours of learning activity, it can be credited 2 ECTS. Each institution can realign with its own system. For example, the calculation from ECTS points to SCQF points is quite simple – you multiply the ECTS points by 2 (and conversely as you would expect to convert SCQF points to ECTS you divide by 2!). 10 hours - 1 SCQF point is the smallest piece of learning that can be recognised on the SCQF and there is no upper limit. For some qualifications there are rules and limits in terms of credit (e.g. 60 ECTS for two semesters, Scottish Higher National certificate is 120 SCQF credits). Larger qualifications will mostly be modular and be made up of modules or units each of which will have a credit value.

The objective is to associate to each innovative activity, a level (low - medium - high) for each of the 4 VUCA criteria and to highlight the D-Skills level associated with the activity or its capsules. When looking at an activity with learners, course managers should try to allocate where the degree of VUCA exists in relation to the seven Decision skills statements.

Table. Analysis Matrix

	D1				D2				D3				D4				D5				D6				D7											
	V	U	C	A	V	U	C	A	V	U	C	A	V	U	C	A	V	U	C	A	V	U	C	A	V	U	C	A	V	U	C	A				
None																																				
Low																																				
Medium																																				

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assessed by faculty with criteria on various experiences, reports and oral defence, 2 ECTS credits were possible to obtain for the one-week course and its capsules. Thanks to the RU TL, some students gain 2 ECTS credits for the week. It is useful to document options for summative feedback alongside the 'Toolbox'.

Resources




As each activity would require an assessment and then verification, potentially this could take additional staff hours (creation, cross-checking, verification, marking) also additional infrastructure such as locations and invigilators. It would be of great benefit to produce model summative assessments as follows, or with online tools

The image shows a hand-drawn assessment tool titled "DAhoy TOOLBOX". It features a grid with 7 rows of activities and 5 columns of skill levels. The activities are: D1. Recognize and qualify a situation with VUCA context, D2. Analyse a situation, D3. Make judgement, D4. Use competency or VUCAly, D5. Organize and implement actions, D6. Take responsibilities in the DM process, and D7. Learn from experience. The skill levels are: 1. no knowledge nor skills/practices, 2. very simple knowledge and practices, 3. practical skills employed in simple situations, 4. skills mobilized in some situations with high magnitude, and 5. proved skills and competences in various VUCA situations with high magnitude. The grid contains colored dots (green, red, blue) indicating ratings. Below the grid, there is a section titled "What was the magnitude of the situation you observed?" with a scale from low to strong, and a table for "Validity", "Uncertainty", "Complexity", and "Ambiguity" with corresponding colored dots.

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Logo	Platform
 Drive	<p>GoogleForms, to create a <i>survey</i> and edit it with others at the same time. ... and <i>Forms</i> will pick just the right colours to complete unique <i>form</i>, or choose from a set of templates.</p> <p>https://www.google.fr/intl/fr/forms/about/</p>
	<p>Kahoot! library with quite a few helpful extras: guides to Kahoot!'ing, game planning templates, professional development resources, and more.</p> <p>https://kahoot.com/</p> <p>hash-tags #Dahoy #decisionship #ahoy #decisions</p>
	<p>Moodle questionnaires enable staff to obtain feedback from students, with an option for the results to be anonymous. To help with consistency and reduce repetitive tasks template questionnaires can be constructed and deployed across any number of modules.</p> <p>https://docs.moodle.org/36/en/Setting_up_a_questionnaire</p>

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	<p>Metimeter permits to quiz audience during presentations, make presentations exciting and increase the energy level with fun, free and interactive quizzes. https://www.mentimeter.com</p>
	<p>Sqily, a Platform for school communication and mutual validation of skills, offered by the Swiss Higher Education School. https://www.sqily.com/</p>
	<p>Paper & pencil, as proposed by LEC for DAHoy final questionnaires</p>

Links to other RM's

RM	Little	Some	Significant	Explanation
RM1			X	The principles must be adopted for assessment to be carried out
RM2			X	The learning outcomes must be established to be assessed
RM3			X	The foundation of the skills which will be assessed
RM5			X	Without integration, assessments are not required
RM6			X	Faculty must be proficient in VUCA to assess students

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RM5: VUCA D-Skills Enriched Curriculum

Business and industry sectors have recognised a growing need to enhance skills that enable students and future professionals to deal with VUCA situations, i.e. with unexpected scenarios and events such as financial crisis, natural disasters, or global pandemic (e.g. public health emergency of international concern such as Covid-19 causing in 2020 huge impact on people's lives, communities, and companies worldwide). According to the European Commission's recommendations, "the skills, competences, and qualifications that people need change over time and must be developed in line with the evolving needs of the labour market. People need to be equipped with a variety of basic skills (including literacy, numeracy, foreign languages and digital skills) and equally higher and more relevant skills as the needs of the labour market evolve. Transversal skills, such as the ability to learn and take initiative, to work with others and solve problems, will help people deal with today's varied and unpredictable career paths". As such, decision-making skills and capabilities for VUCA situations must be integrated in HE and VET curricula, regularly updated according to evolving needs and contexts.

Enriched Curriculum promoting decision-making skills and VUCA learning outcomes is now a major concern. Before the COVID-19 crisis, technological universities were aiming to produce a 2020 STEM graduate, with T-shaped skills. T-Shaped people are those that have good depth of knowledge and skill in one discipline, and reasonable breadth of knowledge and skill across multiple disciplines, thus transferable skills as for judgement and decision-making (I-Shaped have grown and developed good depth of knowledge and skill in a single discipline only). VUCA context is everywhere now, in most sectors. STEM graduates must be 'versatilitist', a quality reinforced thanks to versatile-oriented curricula.

Goal

In 2016, ten actions to help equip people in Europe with better skills were defined by the European Commission (i.e. Recommendation on Key Competences to help more people acquire the core set of skills necessary to work and live in the 21st century, promoting entrepreneurial and innovation-oriented mindsets and skills²).

Opportunities in the preparation of highly skilled workforce for the industry around what could now be called *decisionship* is to be more deeply considered in HE and VET sectors. Decision is not only about knowledge, it is also about skills. This is the responsibility of HE and VET institutions: training future graduates, so that they can turn knowledge into skills, and be able to provide the best professional answer when faced with VUCA circumstances.

To emphasise the importance and quality of decision learning in programmes and courses, and HE or VET institutions must commit adequate methods and processes for decision skills curricular

² http://europa.eu/rapid/press-release_IP-16-2039_en.htm

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integration. In curricula, the purpose, methods, pedagogical styles, and the content of learning have to be meaningful and integrated in terms of transversal skills at HE and VET schools.

Stakeholders

Stakeholder definition	The role of the RM
Curriculum designers	To integrate decision skills statements in programmes, reframe courses and foster the inclusion of some decision T&L capsules
Programme leaders	To stimulate and positively communicate on the needs of transversal decision skills and VUCA considerations, inspired by required graduate outcomes, accreditation and EU education policies, companies and local territory needs.
Students	To participate in the course and capsule evaluations of decision skills and VUCA considerations
Companies & professionals	To participate in the programme evaluations of decision skills and VUCA considerations
Lecturers and Profs	To participate in the course and capsule evaluations of decision skills and VUCA considerations
Quality assessors	To regularly verify and approve alignments to the skill needs

Description

The DAHoy Enriched Curriculum Reference Model strongly recommends that:

- Teaching & Learning activities which develop decision skills are to be integrated in the educational programme at a global level in HE and VET institutions, in line with the Bologna processes and quality assurance purposes, as ENQA and EQAVET recommendations for accreditation and quality enhancement;
- the Teaching & Learning of Decision skills should not be considered as a single view of decision-making (e.g. Maths, Social, Career) or as an add-on or option to an already existing HE or VET curriculum, but as an integral part of it. All courses relating to VUCA considerations and decision skills are to rely on the same toolbox model (learning outcomes syllabus, qualification statements and levels, VUCA grids);
- courses and various decision capsules are mutually supporting connections among related and supporting content and experiences, with VUCA D-Skills learning outcomes.

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A learning capsule is defined as a course offer of 2 hours to 20 hours, relying on active and/or experiential pedagogy to reinforce dedicated skills aside knowledge for VUCA situations. Capsules are interwoven with the learning of related disciplinary knowledge, and other skills, with applications in professional-like environments and attitude consideration;

- Programme leaders and Curriculum Designers are to be involved in the planning of Teaching & Learning activities to achieve transversal skills, including decision skills by the integration of T&L capsules. Programme leaders and Curriculum Designers must have a basis of decision knowledge and the VUCA perception of their graduate working fields.

Rationale

In order to better prepare future professionals to make more reliable decisions in unforeseen VUCA environments, embedding decision skills into a curriculum is essential and institutions should formally consider instilling some VUCA aspects into their programmes, aiming to prepare students to confront unexpected situations in the context of decision-making and leadership and for facing a rapidly changing world. For such, to meet the DAHoy Enriched Curriculum Reference Model, HE and VET institutions should

- at least, check that an explicit plan to integrate decision skills is in place in the programme. For the better, formalised and managed processes to ensure decision skills VUCA courses in curricula are in place and updated appropriately at institutional level, according to the professional skills, accreditation and policy requirements, following the DAHoy Enriched Curriculum maturity model;
- support the coherent inclusion of active and engaging pedagogical models around the various dimensions of decision skills, and to consider these skills as transversal skills. Decision Making skills be addressed comprise Math-based Decision Making, with rationality; Social-based Decision Making, including people's interdependencies and social identities; and Career-based Decision Making, to better choose one's own career path. The learning outcomes are mapped to formal courses and co-curricular activities that make up the curriculum is in place;
- master decision skills to be assessed by various stages of magnitude, e.g. from partial application, realisation, adaptation, to anticipation in various VUCA situations;
- follow curriculum constructive alignment methods (Biggs, J., & Tang, C., 2007, "Teaching for quality learning at university"), with clear defined decision skills statements, set learning outcomes, courses (minors/majors, projects, WBL experiences or large electives) and capsules integrating decision learning outcomes at various places in the curriculum;
- regularly revise their programmes and courses to be grounded in a clearer understanding of the perceptions and expectations of students and fully aligned with the institution's vision and missions to accelerate pedagogical innovations and nucleate their HE and VET systems for VUCA circumstances. Various stakeholders participate in the programme evaluation of decision skills and VUCA considerations in courses, inc. students,

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companies, and faculty staff. Alignments are regularly verified and approved by appropriate groups.

Links to other RM's

RM	Little	Some	Significant	Explanation
RM1			X	DAhoy-like visions and strategies to be taken as a source of inspiration by programme leaders for defining training missions of the institution and programme evaluations.
RM2	X			DAhoy learning outcomes to be taken as a source of inspiration for programme outcomes, crediting and certification.
RM3		X		Integrated T&L capsules can take inspiration from DAhoy T&L models and RM3 capsule samples. DAhoy analysed capsules from the three 2018 JSTEs and three 2019 TLs could also be used (available in the DAhoy section of the website).
RM4	X			DAhoy assessment grids and questionnaires (qualitative & quantitative) to be taken as a source of inspiration for constructive alignment principles.
RM5				NA
RM6	X			Courses under the scope of curricular integration should be designed and taught by trained Decision & VUCA aware staff

The DAhoy O3 chapter report on curricular integration methods may be used as a basis to define some institution processes according to the local needs and context.

RM6: VUCA D-Skills Teacher Competence

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To support Teaching & Learning offers which support decision skills outcomes, teaching staff competence is a requirement. Faculty are expected to teach courses or curriculum parts which includes transversal decision skills, integrated with disciplinary knowledge, understanding and problem solving. In many universities, research-driven, Professors, Associate Profs, lecturers and teaching assistants tend to be experts in their respective disciplines. In the VET or Adult Training sectors, trainers are more linked to professional needs and qualifications. Nevertheless, decision skills are transversal to many disciplines and professions and can range with variety across fields and sectors. Methods and tools to guide the decision-making process of individuals or groups differ, even between the cultures (e.g. rational or technocratic styles, mindful styles). Even more, a specific decision theory or model, knowledge-based, is not always valuable in a specific VUCA situation where acting has its constraints (e.g. snap decision requirements under strong time constraints, no action via wise wait & see decision).

To reinforce the pertinence of decision skills in HE and VET programmes and the quality of decision learning with accurate assessments in various pedagogical styles, HE and VET institutions need to commit adequate resources for faculty staff development. Faculty training and competence in decision-making skills and for VUCA considerations is now a concern for educational quality.

Goal

The goals the DAhoy Teaching Competence Reference Model is to reinforce the teacher capacity to:

- integrate or echo decision skills as transversal in their courses
- select adequate pedagogical models and styles to enhance decision-making skills of their learners
- characterise and assess the levels of VUCAity of learning situations
- state and assess student proficiency levels on decision skills
- organise and animate debriefings and reflections with students.

Stakeholders

Stakeholder definition	The role for the RM
Deans	To state transversal skills and VUCA considerations in the programme priorities
Human Resource Managers	To offer training opportunities to lecturers, profs, trainers and teaching assistants on decision knowledge & skills so as innovative VUCA-based pedagogy. To support a recognition system of the engaged staff.

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Lecturers, Profs, Trainers	To participate in training offers, pedagogical conferences on the theme, industrial experiences, so as networks considering decision skills and VUCA in education
Students	To exchange with their peers on VUCA experiences and decision rough and difficulties
Companies	To exchange with the education sector of the VUCA realities of the sector and landmark and offer some workplace <i>experience/visits</i> to academics

Description

Faculty and teachers are to be 'decision-aware' or decision-skilled for kinds of VUCA situations and capable of operating courses in adequate pedagogical models to enhance learner experiences. For such, the DAhoy Teaching Competence Reference Model strongly recommends that:

- actions that enhance teacher competence are formalised in the institution (e.g. appropriate professional development experiences at the university, training, emphasis in performance reviews and recruitment);
- some training opportunities, workshops and CPD events are proposed or imposed within the institution (or externally) to allow lecturers/staff to enhance their competence in decision-making skills and therefore boost the human resource skill capital. The training opportunities are based on the DAhoy capsule examples of decision-making (as for JSTE for adult and faculty staff training) or external certifications likes first aid certification or CPD which can echo somehow DAhoy VUCA D-Skills;
- faculty/teachers are supported to have an industrial or business background, to allow them to draw from professional experiences out of Academia;
- a recognition system is in place in the institution for faculty and teachers engaged in transversal skills integration and innovative learning models (e.g. career pros, SoTL).

Rationale

For such, to meet the DAhoy Teaching Competence Reference Model, HE and VET institutions should

- at least, an explicit plan to support teacher training is in place in the institution. For the better, formalised and managed processes are in place at the institutional level, following the DAhoy Teaching Competence maturity model;

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- provide support for faculty staff to improve competence in decision skills in its three dimensions, MDM, SDM, and CDM;
- host decision specialists in Teachers and Educators staff, as Teachers & Trainers decision-aware only without excessive expertise in theory or model to reinforce the transversal skill and VUCA echoes in other courses targeting different outcomes;
- stimulate and recognise faculty staff and teachers who participate and engage with students in innovative T&L activities for VUCA contexts and transversal skills, and objectively reflect on these activities;
- support and recognise faculty participation in development programmes, forums for sharing ideas, to enable the identification of good practice.

Links to other RM's

RM	Little	Some	Significant	Explanation
RM1			X	Transversal skills and VUCA considerations are in the programme priorities and clearly stated to facilitate staff engagement and limit resistance to changes
RM2	X			DAHoy learning outcomes to be taken as a source of inspiration for faculty and staff training
RM3		X		Staff training offers can take inspiration from DAHoy 2018 JSTEs (available in the DAHoy section of the website)
RM4	X			DAHoy assessment grids may be adapted for annual appraisal review of staff, teacher portfolios, or SoTL
RM5	X			Trained Decision & VUCA aware staff should be identified and recommended for the integration of their courses in educational programmes
RM6				N/A

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Curricular Integration Process



Conceptual Approach

DAhoy-style capsule concept

Capsules, with a timeframe from 2 hours to 2 days (20 hours learning time maximum as experienced and analysed with the DAhoy T&L activities, knowing that 1 ECTS is approximately 20 hours of teaching & learning time), are interwoven with the learning of related disciplinary knowledge and other skills, with the effort of applicability in professional-like environments, including consideration of students' attitude. Each capsule relies on pedagogical intentions and style with the learning goals of enhancing decision-making skills in environments that could be volatile, uncertain, complex and/or ambiguous (VUCA).



Fig. DAhoy capsule inspired by DAhoy FUEIB partner and The Career Guidance Service of the Department of Guidance and Professional Insertion (DOIP) and the Entrepreneurs Club of the University of the Balearic Islands.

DAhoy capsules are proposed in the 13 selected DAhoy courses, available on the website at www.dahoyproject.eu, Reports section, DAhoy Selected T&L Capsules ZIP files. Some others are also described and analysed in the reports of the DAhoy 2018 Staff Trainings of 3 days and in the 2019 Teaching & Learning of 5 days, all available in the same website. To facilitate

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curriculum integration and adaptation to other institutional contexts, a capsule is best specified according to

- general objective
- or specific objectives on decision-making.
- Pedagogical modalities
- target groups
- resource required
- agenda
- assessment mode
- practical details, such as staff profiles, duration, costs and references.

A DAhoy learning capsule is specific to each institution. However, even the workshops are defined as a ready-to-go toolkits in career training courses, these resources are not reusable fully as such, they could inspire programme leaders, educators and teachers in finding examples of capsules already analysed, formative evaluations with career decision skills and proven thanks to the DAhoy partnership.

VUCA D-Skills Curriculum Integration

For a concrete and more profound reinforcement of decision skills all along curriculum and for lifelong learning, various forms of DAhoy capsules can be integrated within programmes, being in Higher Education or Vocational Education & Training. If these skills are to be formally included in the programme outcomes and student development attributes, systemic and iterative instructional methods and processes will be needed at programme level, but in a flexible and continuous manner. The Teaching & Learning of Decision skills should not be considered a single course addition to a curriculum, but an integral part of it via several capsules, and echoed in various existing courses to support transversality. In fact, in integrated curricula, courses are to mutually support transversal skills, and connections with decision-making are to support dedicated learning outcomes, as proposed for example in next Figure for teamwork, communication or critical thinking skills (Fig from Crawley et al.³).

³ Rethinking Engineering Education: The CDIO Approach. Crawley, E.F., Malmqvist, J., Östlund, S., Brodeur, D.R., Edström, K. 2014.

Year 1	Engineering Drawing	Computer Programming	English 1	Eng Materials
	Basic Eng	Eng Mechanics		
Year 2	Mfg Processes	IE Design & Build	English 2	Statistics
	Mini Project	Work Study	English Conversation	Metrology
Year 3	Productivity Management	M/C Design & SIM	Feasibility Study Project	QC
	Pre project	Automation & Control Sys	IE Lab	DOE
Year 4		Cooperative Education Project	Plant Design	
	Skills	Teamwork	Communication	Critical Thinking

Fig. Transversal skills within a B.Sc.-level programme, CDIO example.

Each coloured line represents a skill path between compulsory courses or units from Year 1 to Year 4 (here a B.Sc.-level degree). For example, the critical thinking skill is mostly addressed and assessed in Year 1 via the Computer Programming course, then in Year 3 with the QC and DOE courses to finally be reinforced in the capstone project, whereas the teamwork and communication skills benefit from the coop semester in Year 4. For another example Teamwork skills can be addressed first in Year 2 in the IE Design & Build course via specific linked learning outcomes. Teamwork skills are also addressed at the end of the programme with required higher proficiency levels and completeness via the coop-education and final capstone project. DAhoy decision-making skills can, of course, have their own line throughout the curriculum years in the Figure.

An integrated curriculum should include Decision Making learning experiences that lead to the acquisition of decision skills, interwoven with the learning of disciplinary knowledge, other skills and application in professional environments. Courses and their decision capsules are to support connections at programme level and align with defined D-Skills learning outcomes.

Transformation Support for VUCA D-Skills Integration

For the post COVID-19 period in higher and VET education, transversal skills reinforcement are more than ever needed, and now is a great opportunity for universities to revise programme outcomes and aim for V-shaped perspectives for their graduates. V-shaped people grow in knowledge and skill, they grow in spiral fashion both horizontally and vertically. V-shaped people are the kind that we need for the post-COVID-19, with a focus on careers and competency development, both across and up, and to grow tomorrow's workforce. The quality assurance standards and criteria will have to be revised accordingly. Now is a great opportunity to reshape

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education, with V-shape flexible curriculum more explicitly. The DAhoy integration concern may guide university leaders and managers to accelerate V-shaped and more flexible curricula.

For integration, conforming to constructive alignment principles⁴, a flexible method for curricular integration of courses and capsules, in line with the DAhoy Reference Models, is proposed. It supports an explicit plan to identify ways of integration of D-Skills, by mapping the learning outcomes to courses and co-curricular activities that make up a programme or VET course offers.

To favour a smooth transformation of transversal skills integration, the missions of an institution may provide support to (cf. DAhoy reference Model #1):

- propose to the programme council revisions and improvements to the training programme with the implementation of the skills approach,
- explain the vocabulary and expectations of the competence and skills approach with student-centred learning models, aside knowledge-based approach and teacher-centred teaching,
- organise exchanges of practices between teacher researchers as part of the programme
- follow the alignment of the DAhoy Reference Models with each other and with the lessons learned,
- share information and support for appropriate funding to promote the development of Student centered learning styles and skills, contribute to the reflections on the adaptation of premises, equipment, and resources,
- contribute to the dissemination of good practices, etc.

A process for programme leaders

An integrated programme approach helps curriculum designers to properly and precisely define the programme architecture, which includes teaching & training components and capsules. The integrated programme approach is structuring and mobilising for:

- Learners who are at the heart of the pedagogical system and can quickly identify skills that they will have to mobilise and develop in their future or actual professional contexts;
- Teachers who identify their contributions to the development of transversal skills (in line with graduate attributes) or specific to the fields of study;
- Quality Assurance internal staff or accreditation expert evaluators who clearly identify strengths and weaknesses regarding standards and criteria.

The proposed DAhoy process for curriculum integration of capsules is exemplified in the next figure with four phases. It was operated for some DAhoy capsules in 2019 for the teaching & learning sessions. In the first 2 weeks, the perimeter of the capsule in terms of skills and VUCAbilities requirements is formalised with programme leaders and curriculum developers,

⁴ Boud, D. and Falchikov, N. (2006). Aligning assessment with long-term learning, *Assessment and Evaluation in Higher Education*, 31, 4, 399–413

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verifying the coherency in the curriculum with other skills, decision thresholds and VUCAilities of the target learners. Then the capsule design phase engages with educators and teaching staff, aware of the targeted decision skills and VUCA situations to echo. The capsule and its materials are then implemented, before delivering the capsule to students over hours or a few days if a capsule (or integrated in a larger course offer of e.g. 1 month). Assessment on qualitative and quantitative criteria is then conducted with learners and right after the course. It favours an iterative process with improvement of future versions of the course and capsules.

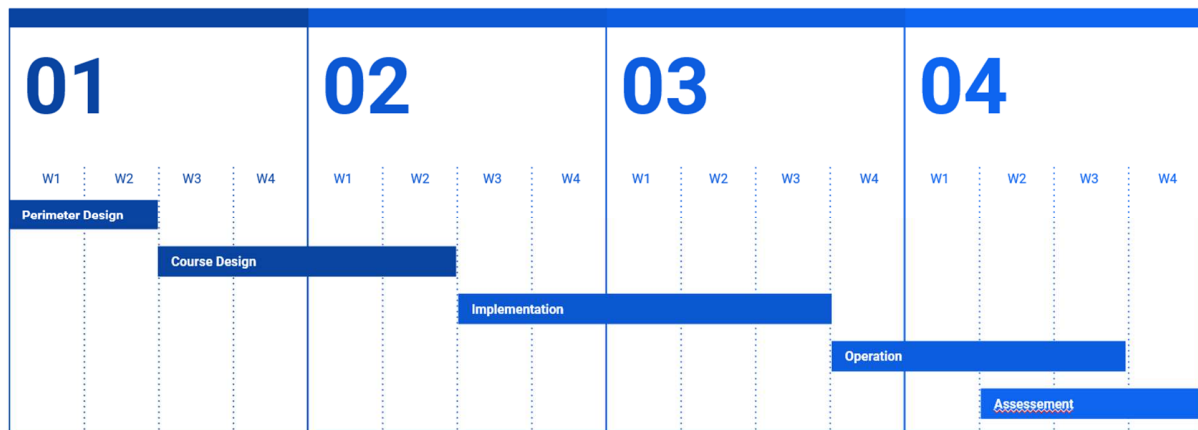


Fig. A capsule integration process instance in 4 months with phases.

More generally, as time frames depend on each context and whether the capsule or course is to be created, inspired by, or simply realigned, DAhoy proposes to programme leaders up to 18 activities to manage curriculum integration. Each of these activities is context and institution dependant, depending on each maturity on decision skills and VUCAility. As a starting point, and maybe precondition, the method used to (re) design of a course or programme with a transversal skills, including capsules, is fruitfully based on the foundations of the expression of a vision formalised in the educational strategies of the institution as exemplified in DAhoy Reference Model N°1. This vision serves as the seed for the development of the HE and VET student profile and graduate attributes, perimeter design of the course offer, and global programme coherency. Student profile and graduate attributes could be co-constructed with several stakeholders (e.g. students / staff / representatives of the socio-economic world, accreditation bodies) and validated by programme councils.

Each of the phases activities are presented hereafter, more recommendations than prescriptions. They are thus to be adapted in each institutional context and needs, regarding the programme and process maturities on curricular flexibility and transversal skills integration.

Perimeter design phase

1. To recognise transversal Skills and especially Decision skills at institution & programme level

- For such, the programme or course designers may take inspiration on the

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- proposals of DAhoy Reference Model N°1
2. To enhance faculty teaching skills on Decision Skills
 - For such, the programme or course designers may take inspiration of the proposals of DAhoy Reference Model N°6
 3. To add Decision Skills statements in the programme outcomes and student graduate attributes (syllabus outcomes)
 - For such, the programme or course designers may take inspiration of the proposals of DAhoy Reference Model N°2
 4. To check adequacy/relevance of these Decision Skills statements with either the National qualification Framework or EQF
 - For such, the programme or course designers may verify the mapping of the selected programme and learning outcomes with their national qualification framework guidelines.
 5. To check the possibility to qualify each Decision Skills programme outcomes in terms of qualification levels
 - For such, the programme or course designers may verify adequation of the selected programme and learning outcomes with their national qualification framework guidelines, inc. levelling

Content design phase

6. To identify best practices and possible innovations for enriched curriculum with transversal skills
 - For such, the programme or course designers may take inspiration of the proposals of DAhoy Reference Model N°5
7. To benchmark the curriculum with existing Decision Skills learning outcomes to identify areas of reinforcement
 - For such, the programme or course designers may take inspiration of the proposals of DAhoy Reference Model N°2
8. To explore the learning resources that are made available or could be reused or extended
 - For such, the programme or course designers may take inspiration of the proposals of DAhoy Reference Model N°3
9. To write down Decision Skills Outcomes and assigns some to curriculum contents (new or existing courses), taking into account the "context" (age, programme, qualifications, etc.)
 - For such, the programme or course designers may take inspiration of the proposals of DAhoy Reference Model N°3
10. To qualify for the degree of VUCAity of courses or capsules
 - For such, the programme or course designers may take inspiration of the proposals of DAhoy Reference Model N°3 including the VUCA table.
11. To derive own set of VUCA criteria for each course or capsule
 - For such, the programme or course designers may take inspiration of the proposals of DAhoy Reference Model N°3 and DAhoy VUCA toolbox.
12. To design, reuse or extend Decision Skills capsules
 - For such, the programme or course designers may take inspiration of the proposals of DAhoy Reference Model N°3 and the pool of DAhoy capsules available on the website www.dahoyproject.eu
13. To check the possibility to provide ECTS or national credits for the course and its capsules

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- For such, the programme or course designers may conform to their national accreditation bodies, qualification recognition system, and professional branch certifications

Implementation phase

14. To choose/select the learning styles that will suit objectives
 - For such, the programme or course designers may take inspiration of the proposals of DAhoy Reference Model N°3
15. To insert capsules in the appropriate part of the Learning Programme
 - For such, the programme or course designers may take inspiration of the proposals of DAhoy Reference Model N°5
16. To operate and analyse the Decision Skills courses and capsules
 - For such, the programme or course designers may take inspiration of the proposals of DAhoy Reference Model N°4

Assessment phase

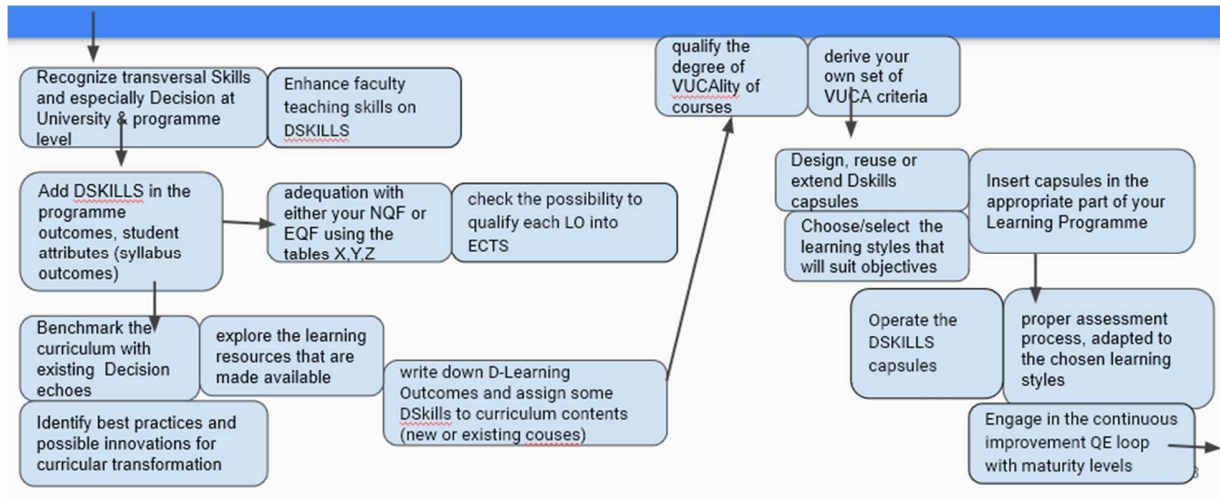
17. To properly assess students, adapted to the chosen learning styles. The learner assessments are to be produced in a spirit of progressive validation.
 - For such, the programme or course designers may take inspiration of the proposals of DAhoy Reference Model N°4
18. To engage in the continuous improvement loop with maturity levels
 - For such, the programme or course designers may take inspiration of the proposals of DAhoy maturity levels for each of its Reference Models

Discussion

The DAhoy project team had many discussions about the different approaches, flexible or formal, to the inclusion of decision skills in learning and teaching. Institutional management and culture differ on quality enhancement processes and curriculum renewal processes in each partner and countries, also depending on the sector (e.g. HE, VET), but also on the different levels to which it is embedded and the different environments in which partner organisations work in their countries: different NQFs with different rules, different QA agencies, differing sets of qualifications and a range of approaches to the academic and to VET qualifications. As such, all these activities are to be adapted to the context and could be reorganised to the needs and priorities by programme leaders. However, the six DAhoy reference models, including their own maturity models but with a shared scale on process maturity, have been developed in such a way as they are 'without barriers'; they can be used by every programme leader and programme designers, no matter what stage they are and what their external factors are. As an example, these activities can be organised as in the following workflow for curricular integration of some DAhoy-like capsules:

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Maturity Models for Continuous Improvement

To stimulate and foster quality enhancement and continuous integration of new concepts at programme level (meso to macro levels for Faculty or VET institutions), different approaches for quality assessment are used in higher education. In DAhoy, to support continuous improvements in the HE and VET sectors for transversal Decision skills, criteria are parts of the proposed reference models, possibly associated with measurement models for interpreting the data and showing evidence of integration.



According to Bennedsen et al. 2018⁵, educational institutions see frameworks and requirements as a key consideration in how they develop their programmes, and consider the teaching and learning experience of their students. In the context of engineering education, the authors argue that one solution for enhancing the quality is the use of maturity levels with flexible and incremental enhancements. To confront institutional inertia in educational programme change or renovation at a systemic level, rather than at a course level only (via a motivated lecturer), benefits from maturity assessment on an ordinal scale may smoothly facilitate quality enhancement. A process measurement framework increases the agility and pace of educational evolution or transformation. Maturity models from quality assurance and quality enhancement processes are followed on their methodological foundations.

A DAhoy framework with maturity models to sustain processes

Maturity models from quality assurance and quality enhancement processes are followed on their methodological foundations. Capacity and rubrics are formalised accordingly, with hierarchical scales of maturity. EQAVET and ENQA standards are taken into consideration, with criteria. This measurement framework increases the agility and pace of educational evolution. Different

⁵ Collaborative Quality Enhancement in Engineering Education: an Overview of Operational Models at a Programme Level. Bennedsen, J., Rouvrais, S., Roslof, J., Kontio, J., and McCartan C.D. [EJEE](#) European Journal of Engineering Education, Pages 73-88, Feb. 2018.

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approaches for quality assessment are used in higher education. To support continuous improvements in the HE and VET sectors for transversal decision skills, standards and criteria are parts of reference models. Rubrics with process maturity measure the programme's progression against the DAhoy reference models. All 6 DAhoy RM forms an overall package which permits enhancing systemically in programmes the transversal decision skills approach. The generic rubric is used and specialised in each concern, respectively RM1 to RM6.

A good starting point for quality enhancement is systemic educational frameworks such as the CDIO approach (Conceive-Design-Implement-Operate). One goal of the CDIO Initiative (www.cdio.org) is to improve the quality of engineering education worldwide (Crawley et al. 2007). The CDIO approach consists of three core components to reinforce the quality and alignment of developing programmes: (i) the CDIO syllabus defines the programme goals (ii) the CDIO standards present guidelines on designing and operating the programme, and (iii) the CDIO self-evaluation, thanks to rubrics⁶, measures the programme's progression against the standards (cf. <http://cdio.org/content/cdio-standard-21>). The generic rubric, applicable to various reference models (or standards in the CDIO terms), is presented in the next table.

Table 1. Generic rubric applied to each of the 12 CDIO standards

Level	Description
5	Evidence related to the standard is regularly reviewed and used to make improvements.
4	There is documented evidence of the full implementation and impact of the standard across programme components and constituents
3	Implementation of the plan to address the standard is underway across the programme components and constituents
2	There is a plan in place to address the standard
1	There is an awareness of need to adopt the standard and a process is in place to address it
0	There is no documented plan or activity related to the standard

The CDIO standards are used for self-evaluation purposes and an institution (macro level) or a programme (meso-level) typically identifies arguments for their chosen maturity level per standard. The key benefit is the insight gained from engaging in the self-evaluation process and the next level to achieve, continuously, not the actual level number selected as a ranking.

Hierarchical scale & Process Attributes

In DAhoy proposals, capacity (as reference models) and rubrics are formalised accordingly, with

⁶ J. Bennedsen, F. Georgsson, J. Kontio (2016). Updated Rubric for Self-evaluation (v.2.1). 14. [2016 12th International CDIO Conference, Turku, Finland Available at http://cdio.org/files/document/cdio2016/143/143_Paper_PDF.pdf](http://cdio.org/files/document/cdio2016/143/143_Paper_PDF.pdf)

a hierarchical scale of maturity. Some elements of EQAVET are ENQA standards that could be considered, with criteria. The DAhoy Process capability is also defined on a six points ordinal scale that enables capability to be assessed from the bottom of the scale (i.e. incomplete, level 1), through to the top end of the scale (i.e. innovation, level 6). The scale represents the increasing capability of the implemented process, from failing to achieve the process purpose through to continually improving and able to respond to organisational change for better consideration of decisions Skills and VUCA considerations.

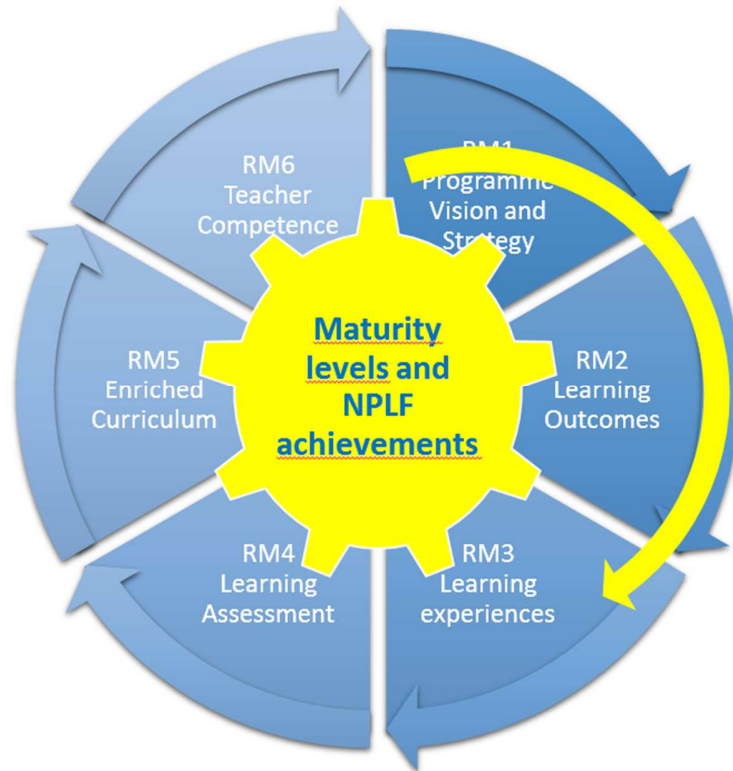
When self-evaluating on a level for a reference model, as the reference maturity could echo in several parts of an institution or programmes but with variety, a subscale could also be introduced to facilitate objectivity per level. For such, a process attributes ordinal rating scale can also be used, in the form of 4 sub-scales as proposed in the ISO/IEC 33020:2015 documents⁷:

- (N) Not achieved
- (P) Partially achieved
- (L) Largely achieved
- and (F) Fully achieved

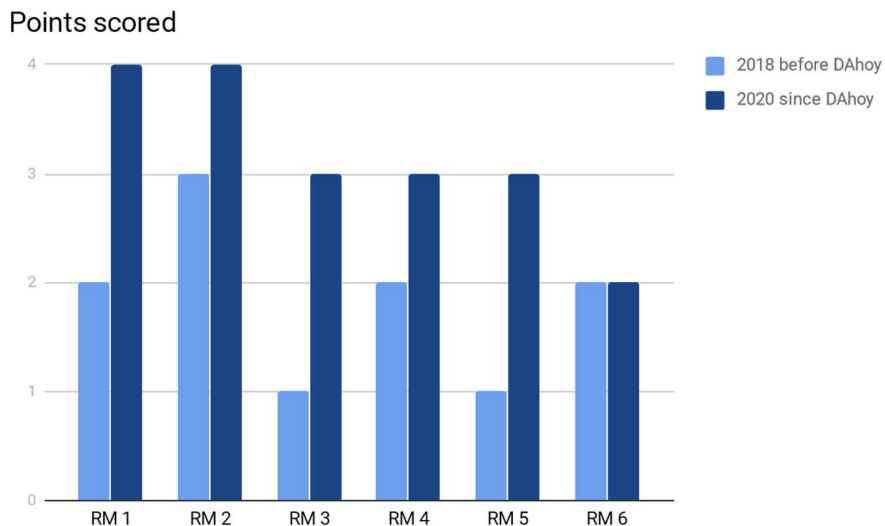
Accordingly, when rating a reference model from 1 to 6 in the ordinary scale for a large programme, it remains possible to characterise the level of achievement and capture a distance to the next level at programme level when various courses are at different levels (e.g. micro levels).

⁷ <https://klevas.mif.vu.lt/~adamonis/iso/ISO%2033020.pdf>

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As an example, a reference model can be rated based on, a self-assessment organised by programme leaders, e.g. for a MSc programme in 2 years integrating transversal decision skills. Some maturity levels may have enhanced (partially, largely or fully), some others still not, and maybe some have regressed.



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RM1 VUCA D-Skills Programme Vision and Strategy maturity levels

1	There exists no plans to incur VUCA principles in the visions and missions of the University, nor teaching agenda in the foreseeable future on decision skills in these contexts.
2	There is an institutional vision stated, and documented plan or activity related to the VUCA criteria in the school for teaching and training purposes. Interest among stakeholders but consolidated activities and functions are missing.
3	There is an awareness of the needs of how to adopt the VUCA teaching criteria and a plan, validated with key stakeholders, is formalised and a process is in place to address them and direct activities are work in progress.
4	There is a plan implemented in place to address the VUCA criteria for teaching and some VUCA activities are in function as part of the teaching schedule and the syllabus, across the curriculum. VUCA advocates are among the faculty.
5	The VUCA statements and decision programme outcomes are formalised in the institution's strategic documents. There is documented evidence of the full implementation and impact of the VUCA based teaching strategy across programme components and several VUCA activities for decision skills reinforcement are in function. A clear emphasis on VUCA teaching consolidated in the syllabus and among faculty members is visible and verifiable.
6	Evidence related to the VUCA based teaching strategy is regularly reviewed according to the missions of the institution and its strategic plans, and used to make continuous improvements. VUCA is teaching as core competence in the graduates profiles in the syllabus.

RM2 VUCA D-Skills Learning Outcomes maturity levels

1	There are no decision skills statements and/or VUCA considerations in the programme outcomes or in the graduate profiles or similar.
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2	There is some reference to decision skills and/or VUCA capabilities in the programme outcomes or in a graduate profile.
3	There has been a gap analysis of how the programmes or practices relate to decision skills statements and/or VUCA capabilities.
4	There is a systematic action plan in place to develop programmes or activities to address any relevant gaps in terms of decision-making skills and/or VUCA capabilities identified in the analysis.
5	There is evidence that decision skills and/or VUCA capabilities are addressed as relevant in programme outcomes and activities. The alignment of the statements to a National Qualifications Framework (NQF) is considered for national recognition of skills.
6	Programme and activities are regularly reviewed and updated in terms of decision-making skills and/or VUCA considerations. Action plans for improvements are developed. The alignment of the statements to a National Qualifications Framework (NQF) has been completed or is in the process for national recognition of skills.

RM3 VUCA D-Skills Learning Experiences maturity levels

1	There is no evidence of active or experiential or DAHoy-style learning methods for decision skills including any VUCA dimensions.
2	There is an awareness of the benefits of active or experiential learning for decision skills and it is encouraged to introduce it across the curricula by integrating the VUCA dimensions
3	Active or experiential learning methods for decision skills are being implemented across the curriculum including the VUCA dimensions.
4	There is a plan and process to include active or experiential learning methods for decision skills in courses across the curriculum. They include the VUCA dimensions
5	There is documented evidence that active or experiential learning for

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	decision skills has been implemented and integrated suitably across the curriculum by including the VUCA dimensions.
6	Internal and/or external groups regularly review active or experiential learning activities on outcome-based learning across the curricula and make recommendations for continuous improvement for decision skills development ; they deal specifically with the VUCA dimensions.

RM4 VUCA D-Skills Learning Assessment maturity levels

1	There is no integration of VUCA nor clear decision skills learning outcomes in the T&L activities therefore no assessments.
2	There is a plan in place to add summative & formative assessments into VUCA and T&L activities including decision skills outcomes. However currently there are no assessments.
3	There are summative assessments in place for all VUCA activities and decisions skills related T&Ls, and there is an action plan in place to include formative assessments.
4	There are summative & formative assessments in place for all VUCA activities and decision skills learning outcomes across the curriculum.
5	There is documented evidence of summative and formative assessment and they are present in all VUCA T&L activities for transversal decision skills. Assessments are verified by faculty members who have a required expertise strong background in VUCA rubrics and implementation and teaching & learning models for such.
6	The summative & formative assessments related to the VUCA based teaching strategy is regularly reviewed, periodically, and used to make continuous improvements. Outcomes for decision skills statements are aligned to National Qualifications Framework (NQF) and both internal and externally verified.

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RM5 VUCA D-Skills Enriched Curriculum maturity levels

1	There is no integration of transversal decision skills or mutually supporting disciplines in the programme, nor VUCA dimensions addressed to categorise pedagogical activities.
2	The need to analyse the curriculum along VUCA dimensions is recognised and initial mapping of transversal decision skills learning outcomes is underway.
3	A curriculum plan that integrates transversal decision skills is approved by appropriate groups, including VUCA dimensions.
4	Transversal decision skills are integrated into one or more years in the curriculum and pedagogical activities echo VUCA dimensions.
5	There is evidence that transversal decision skills are addressed, all along the curriculum, in courses responsible for their implementation with VUCA dimensions alignments.
6	Stakeholders regularly review the integrated curriculum inc. transversal Decisions Skills & VUCA dimensions, and make recommendations and adjustments as needed.

RM6 VUCA D-Skills Teacher Competence maturity levels

1	There are no programmes or practices to enhance faculty competence in Decisions Skills.
2	A benchmarking study and needs analysis of faculty competence and faculty teaching competence has been conducted on Decisions Skills.
3	There is a systematic plan of faculty development in D-Skills, inc. faculty development in teaching, learning, and assessment methods for transversal Decisions Skills.
4	The collective faculty participates in faculty development in Decisions Skills and in teaching, learning, and assessment methods for such.
5	There is evidence that the collective faculty is competent in teaching,

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	learning, and assessment methods for Decisions Skills.
6	Faculty competence in Decisions Skills is regularly evaluated and updated where appropriate, so as Faculty competence in teaching, learning, and assessment methods regularly evaluated and updated where appropriate.

Example of maturity levels at Reykjavik University for 1st year engineering programme

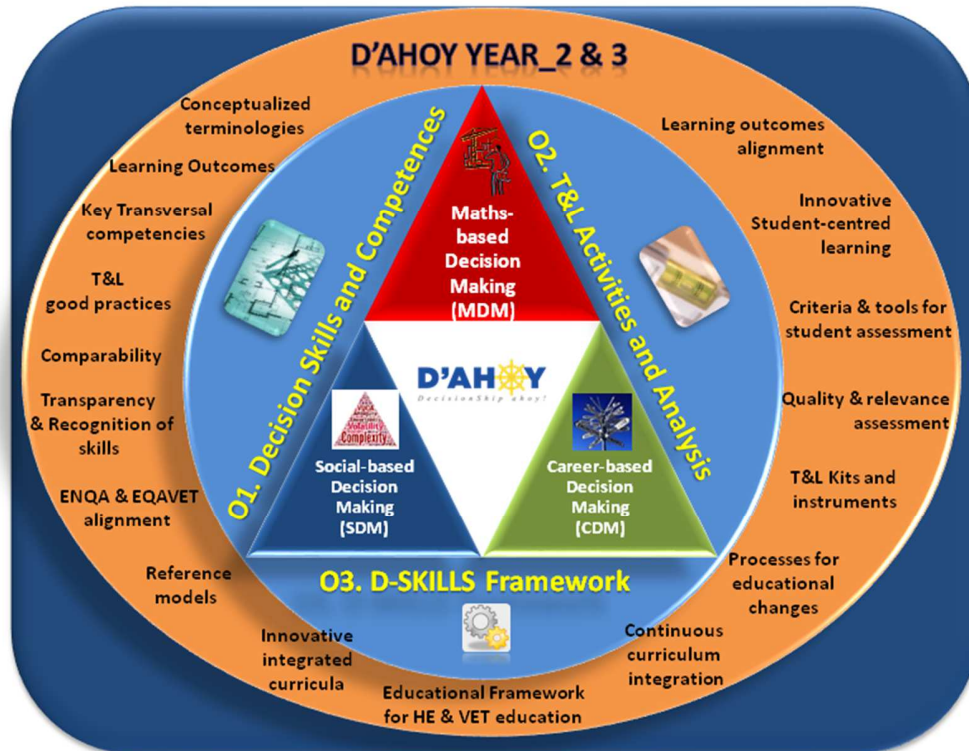
The RMs were applied to assess the current maturity of D-Skills teaching and learning in the context of the project. A grid was arranged and the maturity of the programme evaluated subjectively by two experienced faculty members. Apparently, the six reference models are a decent indicator of the level of maturity and a realistic platform for further development of the teaching and learning programme. The next Table shows the results of the current state. The level numbering refers to the textual description of the maturity in the context of the respective DAHoy RM.

RU 1'ST YEAR ENGINEERING PROGRAM		
REFERENCE MODEL MATURITY ASSESSMENT GRID		
Reference Models	Level	Explanation
RM1 – Context	3	There is an awareness on the needs of how to adopt the VUCA teaching criteria' s and a plan, validated with key stakeholders, is formalized process is in place to address them and direct activities are work in progress.
RM2 – Learning outcomes	2	There is some reference to decision skills and/or VUCA capabilities in the programme outcomes or in a graduate profile.
RM3 – Learning experience	3	Active or experiential learning methods for decision skills are being implemented across the curriculum including the VUCA dimensions.
RM 4- Learning assessment	3	There are summative assessment in place for all VUCA activities and decisions skills related T&L, and there are actionsis a plan in place to includeadd formative assessments.
RM5- Curriculum integration	2	The need to analyze the curriculum along VUCA dimensions is recognized and initial mapping of transversal decision skills learning outcomes is underway.
RM6 – Faculty competence	2	A benchmarking study and needs analysis of faculty competence and faculty teaching competence has been conducted on Decisions Skills.

Table. DAHoy RM maturities of the 1st year engineering programme at RU.

Conclusion

At systemic level, the integrative D-Skills educational framework (models and processes) proposed by DAhoy partner's results in the development, implementation, and transfer of innovative practices at local, regional, national or European level HE & VET organisations.



The previous DAhoy outputs (O1 and O2 reports, respectively from 2018 and 2019, available via the website) resulted in

- education and research mutual reinforcement on decision methods and processes, with surveyed adequate Teaching & Learning approaches, promoting more student-centred and engaging learning approaches;
- a systematic integration of the European and accreditation requirements for Decision skills;
- innovative Teaching & Learning methods and new learning opportunities that effectively support the relevance and development of students' knowledge and skills in Decision-making in three dimensions, as key transversal competences for HE and VET students;
- unified D-Skills learning outcomes, in recognition of these skills through formal certification in the programmes of study included in a relevant NQF; the Erasmus+ learners are

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promoting initiatives such as Mobility of Apprentices and skills needs identification, sector skills alliances for design and delivery of VET and alliances for implementing new strategic approaches;

- transferable learner assessment practises and continuous evaluation methods to improve the quality of Teaching & Learning in Decision, through transdisciplinary approaches;
- more attractive education and training courses defined and assessed, to be coherently integrated with programmes of various HE & VET fields.

This third DAHoy output is to be exploited in various HE and VET institutions, for several fields, ranging from STEM education to others (e.g. business, medicine, politics). It mainly results in key Decision competences reinforcement good practices for HE and VET training, including reference models and methods for introducing those competences in curricula, as for acquiring, delivering and assessing the learning outcomes of those curricula around Decision-making with maturity models of processes for programme enhancements, via the D-Skills framework.

Future Work

The DAHoy framework is composed of six reference models and an integration process including maturity levels for continuous process improvement of educational programmes. As a future work, some analysis based on the references and criteria are to be investigated in the process of engineering or reengineering educational programmes, for the benefit of, at institutional levels, of programme developers, quality assessors, and accreditation bodies. An educational modelling language may also be investigated to provide little more formality in the DAHoy models and processes, for more coherence, consistency and clarity between the standards.

COVID-19 Reflection and Perspectives

The knowledge and skills that our graduates will have to bring tomorrow to actively contribute to the post-COVID-19 period will be decisive. Implication of the HE and VET sectors in this European-level project has been shown to be fruitful for collaborative modelling and innovative practice sharing. Robin Karvo, Human Resources Consultant at Nokia France, recalled in 2018 for DAHoy that "today's business world is changing more quickly than ever before: rapidly evolving markets, regulations, and technologies make it hard to see very far into the future. We all work in increasingly volatile, uncertain, complex and ambiguous business environments" (Career Decision Making'. European DAHoy project Youtube channel, December 2018, at 1'01, available at <https://youtu.be/LC0GRvD9ALq>). Iceland faced a volcano eruption in 2010 which echoed all over Europe. Indonesia regularly faces tsunamis. Now the entire world faces the COVID-19 pandemic, all have societal and business impacts. With the VUCA world, during and after COVID-19, universities must teach students to learn to think and to have the critical mind to analyse and appraise. Universities must transform themselves into learning spaces for students, to prepare

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students to become lifelong learners. DAhoy project ultimately aims to transform the students to be the true leaders for change, especially in the VUCA world via student-centred and experiential approaches and V-shaped philosophy, especially for the STEM and more general workforce. Some partners of the consortium have still reflected on these opportunities, thanks to the Erasmus+ program or national programs and project calls.

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Glossary

- Capsule: a DAhoy-like capsule is a short Teaching & learning unit with targeted learning outcomes and specific learning style of 2 hours to 2 days maximum;
- CDIO: Conceive, Design, Implement, and Operate framework <http://www.cdio.org/>
- CDM: Career-based Decision Making, to choose own's career path and manage his/her competence development
- DAhoy: DecisionShip Ahoy!
- DM: Decision Making
- DOIP: *Departament d'Orientació i Inserció Professional*
- ECTS: European Credit Transfer System
- ECVET: European Credit system for Vocational Education and Training
- EQAVET: *European quality assurance in vocational education and training*
- EQF: European Qualification Framework
- EQFLLL: European Qualifications Framework for Life-long Learning
- ENQA: European Network for Quality Assurance
- ET: Education & Training
- EU: European Union
- JSTE: Joint Staff Training Event
- HE: Higher Education
- HEI: Higher Educational Institution
- IMTA: IMT Atlantique, French Technological University
- ISQF: Icelandic Qualification Framework
- JSTE: Joint Staff Training Events
- MDM: Maths-based Decision Making, with rationality for large projects including models and processes as found in multi-criteria and risk analysis;
- MECES: *Marco Español de Cualificaciones para la Educación Superior* (Spain)
- LLL: Life Long Learning
- ME: Multiplier Event
- Maturity model: a DAhoy maturity model is a tool that helps programme leaders to assess the effectiveness of their processes, to improve their performance, linked to one of the 6 DAhoy reference models (cf. ISO/IEC 33001:2015 Process assessment — Concepts and terminology);
- NA: Non-Applicable
- NQF: National Qualifications Framework
- PRME: Principles for Responsible Management Education
- QA: Quality Assurance
- QAEMP4HEI: Quality Assurance and Enhancement MarketPlace for Higher Educational Institutions www.cross-sparring.eu
- QF-EHEA: Qualifications Frameworks in the European Higher Education Area
- QUESTE-SI: QUESTE-SI is a quality assurance system, whose main objective was to promote quality improvement of sustainable development education at Higher Education Engineering Institutions
- RM: Reference Model
- RU: Reykjavik University
- RNCP: *Repertoire National des Compétences Professionnelles* (France)
- RPL: Recognition of Prior Learning

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- SCQF: Scottish Certification and Qualification Framework
- SDM: Social-based Decision Making, for VUCA contexts, including people's interdependencies and social identities;
- SRSE: Social Responsibility and Sustainability Education
- STEM: Science, Technology, Engineering, and Maths
- TG: Target Group
- T&L: Teaching and Learning
- UN: United Nations
- VET: Vocational Education & Training
- VUCA: Volatility, Uncertainty, Complexity, and Ambiguity
- WBL: Work-based Learning

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Appendix 1: Career decision making course with integrated capsules

Perimeter phase

In the scope of career decision-making skills, students must initiate, by themselves, the necessary transition from the position of a learner to that of a practitioner⁸. Students should learn how to enhance their job applications. But it is also essential to give them the means which will enable them to build their own future professional identity, to become active players in their own learning path, and to plan proactively their own improvement and future career. In order to expose students to career directions as soon as possible, a need to design a career preparation programme with a decision skills continuum over years of a curriculum is an opportunity.

Employability after graduation depends on many factors. This example presents an innovative approach integrating 'professional learning capsules' in curricula. It shows how students should approach career decision-making in complex professional situations, and how higher education institutions and VET schools can contribute to strengthening their learner soft skills of decision-making and judgement. A comparison between the professional programme of Fundació Universitat Empresa de les Illes Balears in Spain, Reykjavik University and IMT Atlantique Technological University in France is presented with recommendations. The commonalities between these three universities are isolated territory, little economic development in Science & Technology, lack of territorial attraction for young graduates. The development of a specific course on the reflection of the professional project, composed of capsules all along the curriculum, allows students to think upstream about their choice of first job and medium career perspective. This course, in the form of a continuum for three years with a marketing approach, brings student maturity, greater decision-making ability and reinforces soft skills. This conceptual proposal may assist academic leaders and flexible curriculum designers by identifying learning areas and capsule-like learning activities, as a transferable result in their own context. As new prescriptive standards and requirements of career guidance training and decision-making appear for higher education, the approach could contribute to better train students, as future leaders and managers, with rational but also emotional intelligence.

Motivation factors for the first job were analysed recently in some HE or VET institutions for STEM. Student respondents mostly considered the content of the mission in the job as a primary criterion, followed by job well-being, style of management, culture and matching their core personal values. Other criteria mentioned match across to the career kaleidoscope such as: teambuilding, responsibilities and autonomy, position or titles ('prestige job'), location (local/international),

⁸ To Embrace Career Decision Making in STEM Education. N. Chelin, G. Matthiasdóttir, Y. Serreau, L. Tudela, S. Rouvrais, and K. Jordan. 11th International Conference on Education and New Learning Technologies. Edited by L. Gómez Chova, A. López Martínez, and I. Candel Torres. Pages 3058–3066. Palma, Mallorca, Spain, 1st-3rd July, 2019.

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training options and lifelong learning, time and style management, facility of career changes to face up difficulties, etc. With six dimensions, the next figure lists and structures such different criteria of choice from an annual survey of the integration of young graduates in French so-called 'Grandes Ecoles' (engineering and business degrees at master level). To anticipate increased job satisfaction, it is therefore crucial to identify student expectations and preferences for their first jobs, so as to align career-preparation courses in the formal engineering curricula. The decision-making process of a student should be seen as a continuous process among which desires, experiences, capacities and situations would influence and allow him to react to the changing environment.

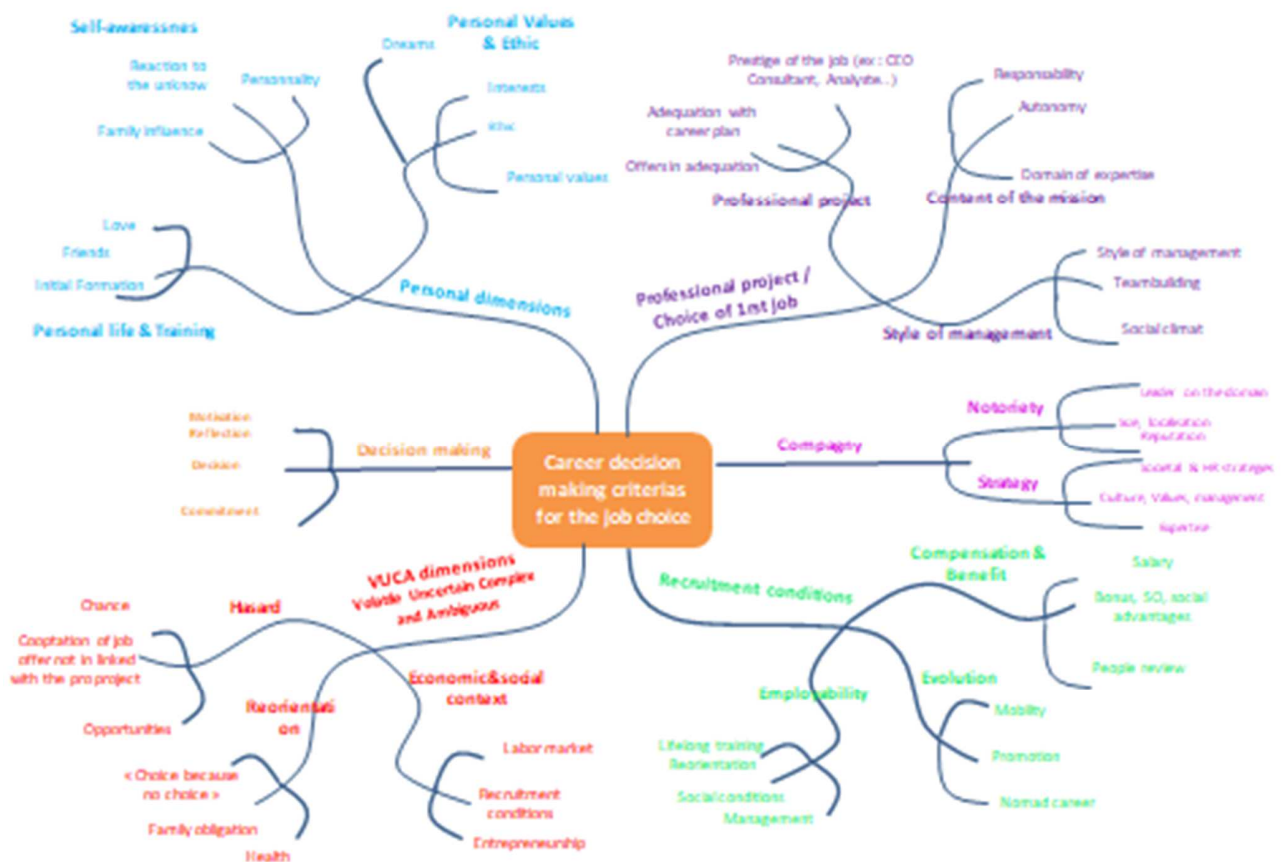


Fig. Criteria of career decision-making for the first job viewed by French students.

Design phase

Learning goals and objectives

How to reinforce STEM students career decision-making skills, to take good career decisions at right times? Several teaching and learning approaches exist. To facilitate the learner career decision-making process and meet some learning outcomes in the scope of self-awareness, self-motivation & personal leadership, social competence, professional roles and relationship with teams and external professionals, a mapping of career guidance courses between three universities is proposed. The three territories of these universities (two islands and a western decentralised region) have rather same economic dimensions and tensions, but different approaches for the students and their profiles:

- IMT Atlantique, France, has a career-orientation course of 63 hours, since 2003 included in the three-year curriculum;
- *Fundació Universitat Empresa de les Illes Balears*, Spain, created a specific department of professional insertion which proposes to all students on demand short courses and offer guidance services;
- Reykjavik University, Iceland, has a career centre which offers guidance services;

The learning outcomes were aligned with the CDIO syllabus standard #2 for the IMT Atlantique course, focusing on the engineering skills: Awareness of One's Personal Knowledge, Skills, and Attitudes; Curiosity and Lifelong Learning; Professional Ethics, Integrity, Responsibility and Accountability; Professional Behaviour; Proactively Planning for One's Career; Staying Current in World of Engineering; Team Operation; Team Growth and Evolution; Leadership; Written Communication; Oral Presentation and Interpersonal Communications; Enterprise Strategy, Goals, and Planning; and Technical Entrepreneurship.

Programme Integration

Many students tend to delay their implication or show low intrinsic motivation in courses if not linked to a just in time need they have (e.g. right before an internship interview or job fair). To take up the challenge of 'too late' motivational factors, the DAhoy project career decision-making team has set up the 'YOU' continuum that covers a 3-year curriculum, with capsules structured as follows:

- Year 1: '**Yourself**' involves students using self-awareness to define their professional profile and describe their skills properly. Self-awareness of DOTS Model and tool is used, which deals with self-assessment and the ability to identify and articulate motivations, skills and personality as they affect career plans. However, this is not always a logical order to achieve the aims of career planning, even facing VUCA circumstances.
- Year 2: '**Open-mindedness**' involves being open to a variety of career projects. The goal is to help students to become more Opportunity Aware and in workshops, we identify opportunities and build the ability to research them.

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- Year 3: **'Up to you'** highlights the fact that if students want to be in control, they will have to be determined to anticipate, take action, commit themselves, make decisions and get off to a challenging start in their work life. Finally, the Transition Learning helps students achieve an understanding of how to seek and secure opportunities.

It is important that each person identify the key competencies, basic skills and transversal skills. During the life career, the student already plays a role in various situations that allows them to develop certain skills. There are students who mediate conflicts, who have the capacity to work as a team, who act as leaders or who come to ask for advice. It is about recognising, deepening and exploiting the skills and competencies that a student may have. However, the teacher will also work on the other two aspects that are essential for making appropriate decisions such as passion and clear objectives. Three aspects (Talent + Passion + Clear Objectives) allow the student to become aware of where they can add value in today's society.

Implementation phase including capsules

The purpose of the CDM training capsule is to provide guidance regarding the making of strategic decisions by students during the university programme that can be fundamental for their future work itinerary. In terms of image and to improve the attractiveness of related offers in institution courses, a marketing action is carried out. For example, a career focused workshop is turned into a 'capsule' of vitamins to give students perception of strength and become an actor of its future.

The metaphor of 'capsule' in two-part envelope of the capsule allows different learning themes to be linked in one but also to contain and meet career-based learning outcomes. A DAhoy-like capsule is a short Teaching & learning unit with targeted learning outcomes and specific learning style of 2 hours to 20 hours maximum. The capsule model aims to develop various abilities, but with a common goal, e.g. to:

- identify the talents and competences of each college student in order to decide their professional project;
- understand the stakes of consequences in the decision-making process.

Experimentation

As experimentation, the University of the Balearic Islands this model for two years. The results are positives: per year, the career centre receives 5,600 solicitations, among 13,000 students. But the capsule, mainly formative and thus on compulsory, is intended for the Master-level students. The idea is that students can make appropriate decisions and have a purpose that allows him to build his future. The career centre organises 2 to 7 capsules per months mainly the 1st semester for senior students. Each capsule session can receive at least 7 participants and a maximum of 25 participants. The capsule session can be a conference or a workshop/hands-on course depending on the speaker. The timing depends on the theme and the speaker (2/3 hours). Attendance is not mandatory, but the students sign the attendance sheet. The teacher will interact

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with the students, to know what their skills, competencies, what moves them and what objectives they have regarding their professional future.

As strengths, the marketing approach has a positive effect on students. There is a varied offer of sessions such as a catalogue. The student can register online quickly. Everything is easy for students: e-mail and SMS support is substantial and relaunches are organised on a regular basis. As weaknesses the student registers but does not necessarily present to the session because he/she does not have the obligation to participate. Absenteeism is therefore present and it is a cost to the career centre. Sometimes the student does not register but he comes to class. The organisation then becomes difficult. To keep registrations going and rich of these observations, the following solutions have been devised, echoed in Figure 3:

- The title of the capsules are to be attractive (ex : instead of 'CV and cover letter', the title of the capsule could be "Make the difference with a good resume and a cover letter");
- The layout of the capsules (and therefore the professional project) is to be thought out and presented at the start-up with a guidance counsellor;
- A mix of collective and individual pedagogical sequence could be considered;
- Mandatory capsules (especially for the E-identity) and optional capsules are to be implemented;
- Presentism is to be required and a written inscription could be recorded in the student's folio;
- The specific courses 'Manager', 'Expert', 'Entrepreneur', 'Consultant' could be given as examples in order to encourage career vocations among students;
- A step point is to be made every year to enhance the cross-cutting skills acquired. Ideally at the end of the course, an oral on the skills acquired is performed with the guidance counsellor. A synthesis is written in a lifelong passport or folio for formal recognition of learning.

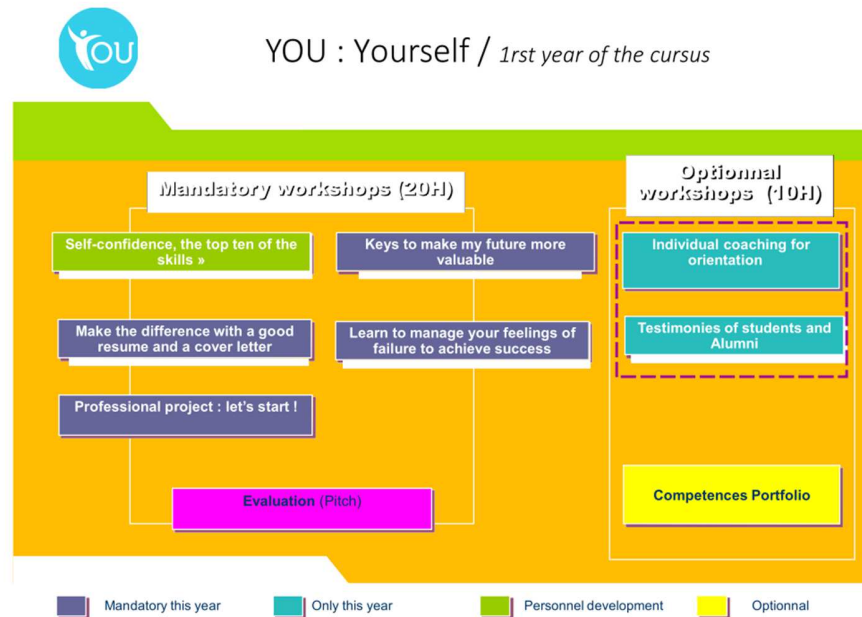
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The YOU activities over three years



YOU Year 1: Self-awareness to begin professional project reflection: If considering a 3-year curriculum (but the approach can be transferred to 4, B.Sc., or 2, MSc level), during the first year of their curriculum, students learn how to develop their professional profile, use their online profiles relevantly and cautiously, and build up their skills portfolio. Besides, they gain the set of skills they need to interact with corporate staff. Students thus gain in self-confidence and develop the ability to adjust their education and training to their aspirations, thanks to the capsules presented in Table syllabus and Figure pedagogical programme.

Table.YOU Year 1 ' Yourself' syllabus, Mandatory (M), Optional (O), Collective (C), or Individual (I).

YOU capsules	Pedagogical objectives	M/ O	C/I	DAHoy skill and level of criticality [8]
'Self-confidence, the top ten of the skills'	Emotional intelligence skill rooted in the ability to recognise one's own. Emotions according to Goleman, [9]. The assignment for this topic is to apply at least one positive habit over the course to cultivate a positive mindset. This personal development is the first step of management leadership attitude. Decision tools: VIA characters test	M	C	D3 Make judgement /Medium
'Self-awareness test'		O	I	

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'Make the difference with a good resume and a cover letter.'	The outcome is the creation of a professional identity (including one's e-identity), and students are also introduced to the process of personal branding. Decision Tools: QQQCP	M	C & I	D5 Organise & implement actions /Medium
'Keys to make my future more valuable'	Using mind maps to decipher job postings. Decision tools: mind mapping for horizontal vision.	M	C	D5 Organise & implement actions /Medium
'Learn to manage your feelings of failure to achieve success'	Positive mentality and setting out arguments competitively, considering the opportunities near. Self-motivation is about the ability to motivate oneself and others. Decision tool: diagram KJ	M	C	D6 Take responsibilities in the decision process /Low
'Professional project: let's start!'	Scenarios of orientation and career paths. Know and use your values and aspirations even before finalising a favourite professional project.	M	C	D1 Recognise & qualify the VUCAity /Medium
'Competencies portfolio'	A portfolio of evidence knowledge, skills that will be updated throughout their curriculum and later in their work life. Pedagogic Tool: Self-analytical thinking is co-constructed and shared in peer learning session.	O	I	D5 Organise & implement actions /Low
'Testimonies of alumni and professional managers'	Testimonies of alumni to discover the engineer and manager jobs. Decision tools: Reality of the labour market	O	C	D3 Make judgement /Low
'Coaching'	Coaching in face-to-face feedback, help students to gain in maturity, reinforcing strengths, skills, character, feelings, and motivations. Decision tools: individual action plan with SMART objectives.	O	I	D3 Make judgement /High
Evaluation	Pitch E-identity Decision tool: Feedback of professionals	M	I	D6 Take responsibilities /High
Certification	2 ECTS	M: 20H O: 10H		

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YOU Year 2: Open mind and choice: During the second year of their curriculum (before their final year), students plan their career for a variety of situations, and update their professional profiles and skill portfolios, as seen in the capsules of Table syllabus and Figure pedagogical programme. Students are now capable of anticipating and learning from failures. There is indeed a huge amount of training opportunities and career prospects, but all are uncertain, changeable, complex and ambiguous. The student’s corporate network is expanding and is used to make selected contacts and open options in the ‘hidden market’.

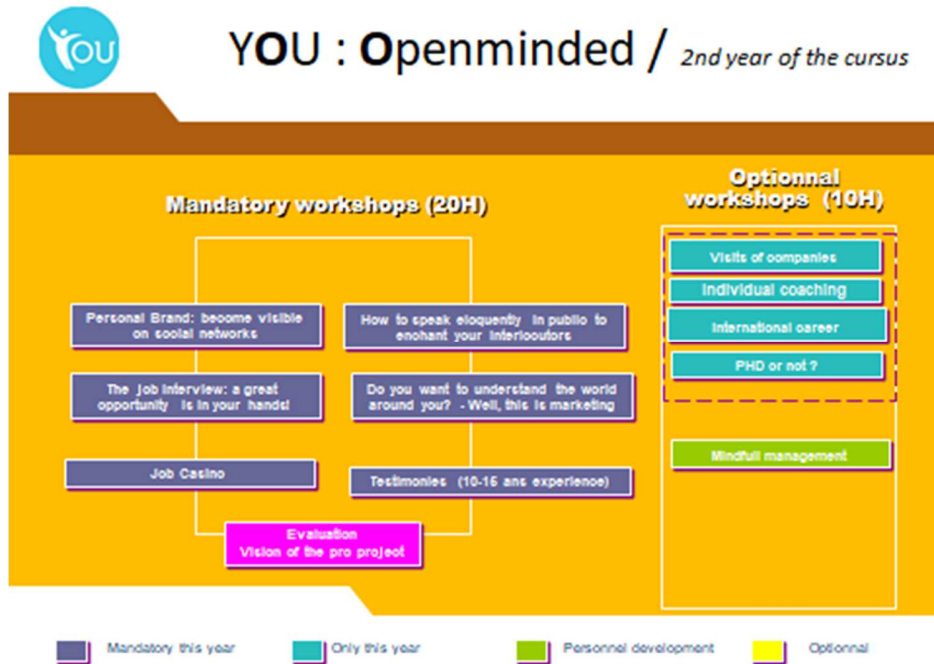


Table. YOU Year 2 ‘Open-mindedness’ syllabus, Mandatory (M), Optional (O), Collective (C), or Individual (I).

YOU capsules	Pedagogical objectives	M/ O	C/I	DAhoy skills and level of criticality [8]
‘Personal Brand: become visible on social networks’	E-identity on linkedIn and networking. Decision tools: experiences of professionals, recommendations.	M	C	D4 Face complexity /Medium

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'The job interview a great opportunity is in your hands!'	Recruitment tools. Students compare recruitment company processes and sharpen their arguments in a competitive approach. Decision tools: comparison, simulation play roles.	M	C & I	D4 Face complexity /Medium
'How to speak eloquently in public to enchant your interlocutors'	Oral Communication. Communication is significant in the engineering professional role and in studying communication, students learn various non-verbal and verbal communication tools, how to ask good questions and how to listen actively. Decision tool: Feedback and analysis	M	C & I	D6 Take responsibilities in the decision process /Medium
'Do you want to understand the world around you? – Well, this is marketing'	Personal marketing and open-minded about other practices. Presentation Skills focus on oral presentation techniques where attention is given to body language, oral performance, and visual presentation.	M	C	D3 Make judgement /Medium
'Job Casino'	Choice of professional scenarios with '6 huts' decision method. Students are encouraged to consider the range of their possibilities, and how they may start taking actions or set up a business. Tool: DAHoy card games [2].	M	C	D2 Analyse VUCA situations /Medium
'Testimonies of alumni and professionals'	Testimonies of alumni to discover the engineer and manager jobs. Decision tools: reality of the labour market.	M	C	D3 Make judgement /Medium
'Coaching'	Coaching in face-to-face feedback, help students to gain in maturity, reinforcing strengths, skills, character and motivation.	O	I	D3 Make judgement /High
'Visits of companies'	Company's visits in small groups to discover the reality of the labour market. Decision tools for entrepreneurship.	O	C	D3 Make judgement /Medium
'International career'	Working all over the world.	O	C	D2 Analyse situations /Low
'PhD or not? '	Following the studies to become an expert or not?	O	C	D2 Analyse situations /Low

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'Mindfull management '	Stress management and self-awareness for a better knowledge of their choices (personal leadership).	O	C	D5 Organise & implement actions /Low
Evaluation	Vision of the professional project to decide about the 1 st job (and not internship).	M	I	D5 Organize & implement actions /High
Certification	2 ECTS	M: 20H O: 10H		

YOU Year 3 : Orientation to become an actor of his own path: During the final year of their curriculum, students make up their minds about a work field and devise a strategy for their trajectory, factoring in the changeable, uncertain, complex and ambiguous environment. Support includes setting out a personal action plan ("Smart Action Plan") and managing unforeseen circumstances, as seen in the capsules of Table syllabus and Figure pedagogical programme.



YOU : Up to you / 3rd year of the cursus

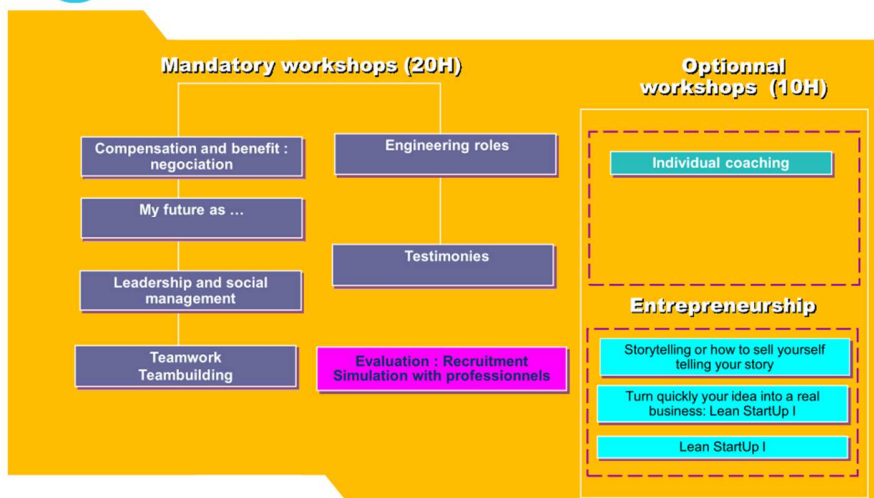


Table. YOU Year 3 'Up to you' syllabus, Mandatory (M), Optional (O), Collective (C), or Individual (I).

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YOU capsules	Pedagogical objectives	M/ O	C/I	DAhoy skill and level of criticality [8]
'Negotiation compensation and benefit'	Salary negotiation and hiring conditions. Decision tools: comparison, salary survey.	M	C	D2 Analyse situation /High
'My future as...'	Professional project is formalised with MECE (Mutually, Exclusive, Collectively, Exhaustive) tools.	M	C & I	D3 Make judgement /High
'Leadership and social management'	Interpersonal leadership and social behaviour cover how to interact positively with others and how leadership affects productivity, looking at, e.g. leadership theories, dysfunctional teams and empathy.	M	C & I	D2 Analyse VUCA situation /Medium
'Teamwork Team building'	Teamwork refers to the social ability to work with other people e.g. engineers, stakeholders, or customers. The students reflect on what leads to effective teamwork and personal effort with others.	M	C	D2 Analyse VUCA situation /Medium
'Engineering roles '	A better understanding of the engineering professional role. Students learn more about the practice by interviewing an engineer alumni or professional manager (job, role, interaction, impacts, etc...) to have an understanding vision.	M	C	D3 Make judgement /High
'Testimonies of alumni and pro-people'	Testimonies of alumni to discover the engineer and manager jobs. Decision tool: analysis of the labour market	M	C	D3 Make judgement /Medium
'Coaching'	Coaching in face-to-face feedback, help students to gain in maturity, reinforcing strengths, skills, character, feelings, and motivations	O	I	D3 Make judgement /High
'Storytelling/how to sell yourself telling your story'	Communication to create a start-up with storytelling technic. Decision tools: pitch to convince bankers and partners.	O	C & I	D4 Face complexity /Low

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Turn your idea quickly into a real business	Lean StartUp1: To test to become entrepreneur	O	C & I	D6 Take responsibilities /Medium
'Lean StartUp!'	Lean StartUp to create a business plan.	O	C & I	D6 Take responsibilities /Medium
Evaluation	Recruitment simulation with 2 professionals (HR and Manager for 2 points of view)	M	I	D6 Take responsibilities /High
Certification	2 ECTS	M: 20H O: 10H		

Formative evaluations

A formative evaluation improves the judgement skills on the part of the students. For each year of YOU programme, specific evaluations have been created with decision objectives and formal deliverables. The YOU method can thus be quickly integrated as a ready-to-go toolkit in career training courses with evaluation and accreditation, to allow any university to implement it more easily and autonomously.

DAhoy – Career Decision Making
YOU Evaluations

YOU – Formative Evaluations – 3 years cursus

Good decision at the right time ! a ready-to-go career decision courses training

STUDENT :

PROFESSOR : |

YOU – 1 st Year – Evaluation 'Pitch to introduce myself'						
Intropection, Self-awareness and Resume level1						
CRITERIAS	Student self evaluation	Professor evaluation	++ A Very good/Good	+ B Can do better !	-- C Insufficient work	D At work !
E-identity Resume			<p>A relevant and attractive CV for the recruiter, in terms of content and form. It brings a real singularity which can trigger an interview. Photo not required.</p> <p>1 - Form One page (good length). The objective is present. Design is attractive to the recruiter. Balanced CV at paragraph level. The "bold" underlines the keywords and not just the titles. Photo is professional. (adapted dress, smile).</p> <p>2 - Substance The title of the CV clearly indicates the objective aimed by the student or his assets. The projects are detailed (3/4 description lines). The student's contribution to the project is highlighted.</p>	<p>An interesting CV. It is well done and it could generate an interview. However, there are still improvements to be made. Photo not required.</p> <p>1 - Form One page (good length). Objective present. Classic design; sober style. The paragraphs are relatively well balanced. Details are missing. No enhancement of keywords. Professional photo adapted.</p> <p>2 - Substance Title of the targeted CV. The formulations of the experiments are general. Personal contribution or skills are not highlighted.</p>	<p>The CV is succinct and the minimum content is included. The objective is not clear or nonexistent. The content and form do not sufficiently highlight the student. Photo not required.</p> <p>1 - Form Unsuitable length (half a page, 2 pages). No goal. Design not worked. Poorly structured CV: the "training" paragraph takes the main place, the Projects section is briefly described. Unsuitable non-professional photo (ex: t-shirt).</p> <p>2 - Substance The title does not indicate a specific target. The Training part is not well developed. Projects or experiences not detailed. Contribution and / or skills of the student not indicated.</p>	<p>The CV does not highlight the career of the student who will have difficulty being invited for an interview by a recruiter. Photo not required.</p> <p>1 - Form The length is not suitable (half a page). No goal. Unworked design. Minimalist CV on the structure. The student does not stand out through an attractive or detailed CV. Unprofessional photo.</p> <p>2 - Substance No title, no cible. The projects and experiences are neither detailed nor valued. Structuring and content of the CV not worked. The student's contribution and skills are not valued.</p>

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Assessment phase

ECTS credits are to be allocated, as capsules meet graduate outcomes and transversal skills, if the student justifies a frame of capsules during the studies, with a staggered timeline (and an accumulation of capsules at the end of the course).

The proposed model has several benefits. It is integrative in formal curricula, flexibly thanks to the capsule model. Curricular introduction can be incremental and iterative. Developing transversal skills, as decision-making for careers, is the key of lifelong career management and the acquisition of leadership dimensions. It is important to train the students with a balance regarding work, health, relationships, and what brings happiness and joy in every day. It also covers building skills and knowledge continuously throughout the life of an individual. This integration proposal may result in a new career preparation programme which permits integrating several new complementary activities into the curriculum over consecutive years. Even though it is too early to derive therefrom a rigorous analysis of the impact of the programme on the career of a junior alumnus, assessment phase may show that students who attended these activities better negotiate their personal and professional projects in making choices which are closer to their present or future aspirations.

Students have a strategic importance on having a challenging job, teamwork, independence, opportunities for development, and a very participative management style. Thus, the innovative capsule programme structure proposed to facilitate student career preparations, both from a technical and managerial perspective, to enter the engineering profession; more fully understanding the various options available to them for decision-making in light of a career kaleidoscope. The proposed model has several benefits. It is integrative in formal curricula, flexibly thanks to the capsule model. Curricular introduction can be incremental and iterative. Developing transversal skills, as decision-making for careers, is the key of the lifelong career management and the acquisition of leadership dimensions. It is important to train the students with a balance regarding work, health, relationships, and what brings happiness and joy in every day. It also covers building skills and knowledge continuously throughout the life of an individual. The DAhoy skills are used to build the programme on decision-making.

The likelihood of realising expressed ideals in the first job may be more objectively interrogated, or analysed quantitatively and qualitatively, when bringing in industry and former students as proposed in this model. Personal aspects such as self-confidence, values, decision-making abilities, stress related to subjects, career choices and personal anxiety, along with key skills and attributes necessary for a successful STEM professional, may also be emphasised in career counselling.

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Appendix 2: COVID-19 crisis at a DAhoy partner university in spring 2020

The 2019–20 coronavirus pandemic, named covid-19, was confirmed to have reached Iceland in February 2020. The response to the pandemic by Icelandic health authorities has focused on social distancing measures such as a ban on assemblies of more than 20 persons and many other restrictions on human activities. Because of this unrepresented risk event, HE schools, VET schools and many other educational institutes in Iceland were forced to rearrange teaching, research activities and other forms of communication within an educational organisation.

Within Reykjavik University (RU) several decisions had to be made to adapt to this unexpected scenario. It can be stated that several decisions under condition of Volatility, Uncertainty, Complexity and Ambiguity were formulated and implemented within a very tight time space.

This gives the DAhoy project an excellent chance to explore how the seven D-Skills of DAhoy were applied unconsciously under the VUCA conditions that suddenly appeared and altered the fundamentals of conventional work within a university. These skills will in the following be aligned with the events that folded out as the covid-19 outbreak that totally changed the situation at Reykjavik University (RU) in February 2020. The seven D-skill set from DAhoy can be used to describe a VUCA situation. This indicates that it can also be used to model an approach to organise teaching learning.

- **D1 Recognise and qualify the VUCA-lity of a family of situations:** The management and faculty at RU had, prior to the situation, heard about the epidemic that began in Wuhan in China late in 2019. News and information on the severity and escalation of the epidemic was though arguably not consolidated until the WHO organisation declared that the epidemic was now a pandemic. Furthermore, all of a sudden several Icelanders, there among RU staff, were diagnosed sick of covid-19 after staying at a ski resort in Austria. All this happened within a few days. The recognition and the doctrine the threat responses came from the Health Organisation and RU was commanded to adopt almost immediately.
- **D2 Analyse VUCA situations:** The situation demanded an immediate response to the risk. The main risk factor is how highly the covid-19 virus is infective having a R0 factor of close to 2.5. The strategy therefore had to close down all communication channels demanding direct human interactions. Furthermore, to limit the damage to students and faculty as possible.
- **D3 Make judgement in VUCA situations:** The decisions risk responses were initially to close the school more or less and adapt from there. People can only enter the RU facilities with pass codes, meetings were cancelled and work procedures revised. February 11th all conventional teaching facilities were blocked and orders given to the RU faculty to prepare for a complete overhaul of teaching tactics going online. An emphasis on the student's welfare was issued in respect of grading and workload. The first tactical guidelines on remote teaching and operations were issued to attempt to strike a balance between

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teaching/learning quality assurance and humanitarian reasons. Moreover, extensive online activities, i.e. lectures and short courses, were planned and made accessible as a sidekick for teachers and faculty to cope with the situation.

- **D4 Face complexity of VUCA situations:** The risk event that suddenly changed the daily routines of teachers, students, researchers and other RU staff members was made even more complex due to the reason that the first part of the semester was coming to an end. This meant that work on assignments to submit at the end of the semester was at its peak, exam preparation for teachers and students was well away and in short, and the covid-19 crisis hit faculty and students at the worst possible moment. In many cases it was next to impossible to redesign courses. The grading system was in many cases redundant and the task to close down the semester with minimal damage to RU's students was huge. The complex situation was dealt with tactically by attempting to simplify the managerial challenges and provide online knowledge as applicable.
- **D5 Organise and implement actions in VUCA situations:** The organisation was primarily to issue simple guidelines on how to adapt. The faculty members were handed out autonomy to implement actions within the general guidelines. Online meeting/teamwork systems were made accessible to students and faculty. Staff meetings were increased in numbers to disseminate the general approach and share experiences and advice.
- **D6 Take responsibilities in the decision process in VUCA situations:** The faculty was in general given autonomy on how to cope with this remarkable situation. Courses and projects are very different from case to case. The responsibility of the admin functions was primarily to lay down the strategy. Teachers, researchers and other field people had to take responsibility to adapt and carry out lectures, assignments, exams and all sorts of meetings via digital media. This led to ethical issues as plagiarism and cheating as the proximity between teacher and student was breached. The teachers had to improvise and come up with fresh solutions to new problems and challenges.
- **D7 Learn from his/her experience of VUCA situations:** At the writing of this text the overall experience is not known. However, the first learning experience indicates that the faculty and students have adapted remarkably well to this covid-19 crisis that rocked the relatively stable environment of an engineering school within a university. New ideas were implemented and it will be interesting to see if this VUCA situation improves teaching and learning at RU in the long run.

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Example 1: Disaster Days – VUCA like scenarios



The engineering programmes at Reykjavik University (RU) have since 2011 run a two-day intensive course, Disaster Days, early in the first semester. The main objective of the course is to enhance interpersonal skills and induct a positive journey for the student through the study programme, as to break up a long semester and open a venue for students to become acquainted with fellow students. The context of the project is an unexpected challenge that has to be dealt with in teams and in a single day. The event is designed in such a way that the scenario awakens the student interest and teamwork appears as a natural way to tackle the situation. VUCA-type of situation has proven particularly fruitful for this purpose,

- In the fall semester 2017, the scenario was the eruption of a prominent glacier-covered stratovolcano that is clearly visible from the campus (Audunsson, Fridgeirsson & Saemundsdottir, 2018). Due to its prominence and the steady threat of volcanic eruptions in Iceland, we felt that it would be suitable for the project. It was feasible to make up a realistic course of events that included both minor and major disasters and ambiguous news bulletins, i.e. about the flooding of glacial rivers isolating a small town, disrupted transportation, ash and tephra flows escalating to an imminent major tsunami hitting the city of Reykjavik.



- Fall 2018 the scenario was again an unexpected volcanic eruption, but this time close to the city of Reykjavik, closing roads, disrupting power lines and shutting down the flow of geothermal water used for district heating. Severe ash fall in the city followed. Here the situation escalated into immediate health hazard due to ash, panic and public unrest, power shortage and plenty of rumours, misinformation and fake news that the students had to deal with.

Both situations on natural disasters are very much plausible in Iceland. The VUCA scenario for Disaster Days in fall 2019 was, ironically, a very contiguous pandemic that spread very fast and with a high fatality rate. The initial epidemic started practically simultaneously in several of the largest cities in the world and therefore quickly evolved into a pandemic. The task presented to the students was to design the first reaction in Iceland, how to isolate Iceland from the pandemic, possibly divide the country into several quarantine areas and estimate if and how the nation could survive in isolation for possibly a few months. This is a true problem for a nation that has developed in such a way that it depends heavily on imported goods. In analysing this event Audunsson, Matthiasdottir and Fridgeirsson (2020) focused on how this event fostered a positive journey for the student. For some reason, the pretend scenario of a pandemic was quickly realised worldwide only three months later as the covid-19 pandemic.

The formal introduction of the VUCA them into RU's Disaster Week is one contribution to the DAHoy project.

Learning goals and objectives

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The Learning Outcomes (LO) for Disaster Week for the last three years were that upon completion of the course the student should

- have experienced teamwork and understand the importance of cooperation and diversity in a group;
- have been introduced to diverse ways in presenting solutions;
- have experienced a situation where decisions and planning are based on uncertain information.

Introducing VUCA, although in a mild manner as in this case, early in a study programme encourages personal interaction within study groups. It may also encourage a more positive attitude when students are faced with uncertain and ambiguous projects later in their studies, paving the way for facing more involved and realistic VUCA situations.

Although not stated explicitly in the formal LO for the course, VUCA aspects and decision-making have played an increasing role in designing the scenario in Disaster Days. The table below is an analysis of the DAhoy defined decision skills and the four VUCA factors for the Disaster Days using the modified VUCA-grid introduced in the DAhoy RM3.

RU 1 ST YEAR ENGINEERING PROGRAM - DISASTER WEEK				
VUCA ASSESSMENT GRID				
DECISION SKILLS	V	U	C	A
D1 - Recognize and qualify a VUCA situation	Medium	High	Medium	High
D2 - Analyse a situation	High	Medium	High	High
D3 - Make a judgment	Medium	High	Medium	Medium
D4 - Face complexity	Medium	Medium	Low	Medium
D5 - Organize and implement actions	High	Low	Medium	None
D6 - Take a responsibility of a DM process	Low	Low	Medium	None
D7 - Learn from experience	Low	Low	Low	Low

Design

The theme is always some sort of disaster and the students have to react to the VUCA-like situation under time pressure and ambiguity. The RU planners try to select realistic events, like eruptions, and the reality of the pandemic late in 2019 was unexpected. It emphasises that unlikely events do happen and one should be prepared for them also. The schedule is as follows (Audunsson, Matthiasdottir and Fridgeirsson, 2020):

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- Wednesday. Four or five weeks into the first semester Disaster Days start on Wednesday afternoon with an hour of short lectures on teamwork and on the importance of being able to do back-of-the-envelope calculations. The same day students are put in groups, typically 6 students in each and from the same engineering discipline. Faculty members are involved such that each one is a mentor for about five or six groups.
- Thursday. Early on Thursday morning all students gather in an auditorium and the unexpected disaster is introduced as a dramatic short news bulletin video made in cooperation with a local TV station. This kick-off event gives the disaster and the task at hand a more realistic flavour and urgency. The scenario unfolds throughout the morning with several fresh news text bulletins to keep up the volatile and agile atmosphere. All Thursday students work in teams and at the end of the day there is a short lecture on presentation methods.
- Friday. On Friday morning the team's work on summarising results and prepare for presenting their results to fellow students in the early afternoon. The presentations are run in often five parallel sessions, about 7 teams in each, and take in a total one hour. After the presentations are completed, the event is over.

Difficulties encountered

Disaster Days have generally been successful and the three learning outcomes accomplished. New students entering the engineering programme have been excited and enthusiastic to participate, and are overall satisfied with the course. The event has gained positive attention from students outside the university. The majority of the faculty supports Disaster Days, as it trains interpersonal skills and is a positive start for the student's journey in the programme. On the other hand, many faculty members are reluctant to participate in running the event, mentioning that they are not confident enough to contribute and it takes time from traditional classes and engineering training. A few of the faculty mention that the event disrupts their regular teaching schedule, but the majority of them appreciate the fact that the students enjoy and see value in the event.

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Appendix 3: in spring 2020, what can be anticipated from the COVID-19 pandemic to improve VUCA training?

The 2020 COVID-19 will change the ways HE and VET institutions train their students and learners. But as of spring 2020, we all need to be careful about making generalisations and conclusions about decisions that have been made and approaches used and their effectiveness at that time when the situation was unclear for so many HE and VET institutions, countries and the international community as a whole.



This analysis attempts to review the 7 DAhoy D-skills accordingly and subjectively:

- **D1. Recognise and qualify the VUCA situation:** Based on how events unfolded early on and news started to come from Wuhan and China, it is clear that authorities, both within China and internationally, needed to be observant, realise early enough that the virus outbreak in Wuhan was potentially a pandemic. Also, authorities had to have the guts to recognise and admit the potential threat. It is now generally recognised that nations where authorities reacted very early were much better prepared and had more control of the epidemic and hence were more able to reduce the load on otherwise overloaded national healthcare system.
 - **DAHoy/VUCA training:** be always on the outlook for potential VUCA events, have the guts to admit early a potential threat, and therefore have more time to prepare and adjust to the situation.
- **D2. Analyse the VUCA situation:** Authorities globally scrambled to obtain information, both quantitative on how the infection spread and on clinical symptoms. This data is a must to understand the situation and prepare realistic models of possible scenarios, and

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hence how best to moderate the effect of the pandemic at all scales, from global to individuals. Of paramount importance was to recognise the most important and vulnerable part of the society, which was most often the health care system.

- DAhoy/VUCA training: gather information as fast as possible, make models and/or outline potential scenarios, realise biases and ambiguous information. Recognise the most vulnerable part that is under threat and make sure it is accounted for in the analysis.
- **D3. Make a judgement:** Different nations and authorities reacted differently to the pandemic, and apparently there was in some cases a conflict between political leadership and professional leadership on how to proceed. Politics and politicians may have hindered proper reaction to the pandemic, ethical questions emerged in some cases, due to a gap between political, egocentric and public interest. In most cases the focus is on slowing the spread of the disease and reduce the overload on national healthcare systems.
 - DAhoy/VUCA training: use the actual data to make informed judgement, be as objective as possible in making judgements, and be open to more than one potential scenario and the situation may change so be open to adjust judgements accordingly. The judgement has to focus on the most vulnerable parts.
- **D4. Face complexity:** Incidentally, where professional task force were in charge of how to handle the pandemic at national levels things appear to have fared better. Nations with egocentric leadership and possibly authoritarian may not have feared either. Ambiguous information, fake news and the unwilling of political leadership to admit the imminent crisis have hampered the proper response. Every individual must have the feeling that he or she is responsible and integral part of slowing the spread of the virus, and therefore the general public needs reliable information from reliable and trustworthy source. As of now, national task forces composed of professionals that have evoked trust among the public are facing the pandemic in a more responsible manner and the public has a more positive experience and expectations.
 - DAhoy/VUCA training: good leadership is of high importance in a VUCA situation, and in some cases the leadership has to be professional and objective, and it must evoke trust by its actions and decisions. Reliable information to all involved may sometimes be necessary. Consider also how to motivate individuals and keep them motivated.
- **D5. Organise and implement actions:** Nations that had plans, were willing and able to implement them, and had better infrastructure was in far better position to control the spread. Also, it appears that where professional bodies were in charge and the public were properly informed fared much better and all involved had more confidence in following new rules and adjusting their behaviour. Where political leaders were the spokespersons for fighting the spread of the virus the public was not as well informed, the trust was less, and it caused stress in individuals.
 - DAhoy/VUCA training: Be prepared to implement actions, involve competent individuals, groups and professionals. Have realistic plans and at the same time be open to adjust the action is needed. Part of the plan is to be able to provide reliable information to all in real time, be aware of potential importance of keeping those involved informed.
- **D6. Taking responsibility:** The international community received information about the impending epidemic at the same time, but how and when decisions were made differed significantly. A few nations appeared to avoid making decisions, pretending the threat was minor and hoped for the best, but others did not hesitate to make informed decisions and

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therefore were able to moderate the overload on the local healthcare system. On the other hand, some national authorities decided initially to do practically nothing. For these nations it turned out that the ones that were willing to revise their decisions timely fared by far much better than the ones that postponed their decision to react, and were severely inflicted due to the delay.

- DAhoy/VUCA training: When faced with a threatening situation, be prepared to make a decision under time pressure, and, as deemed necessary, adapt to a changing situation and revise decisions timely. An integral part of the decision-making process is to be observant and agile in analysing new information.
- **D7. Learning from experience**: It is obvious that the international community, global organisations, nations, families and individuals will learn from the pandemic, and the world has already changed. Learning how the pandemic spread and how to control the next pandemic is of great interest, and implications for global travel, trading and cooperation are of concern. Both political and ethical analysis of the event will come about. Also, questions of why some nations were better prepared and some less, and new geopolitics may emerge. This pandemic has already shown that almost all professions are involved, and need support from each other, both from HE and VET.
 - DAhoy/VUCA training: It is important to learn from experience, especially for complex and often ambiguous events, i.e. VUCA-types of events. Analyse the information given, the basis for the decisions made, unfolding of events and the implications. The analysis also has to be done from the perspective of the individuals involved, his or her ability, personal strength and weakness, and professional training.

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Appendix 4: in spring 2020, what can be anticipated from the COVID-19 pandemic to realign career decision-making?

Already we are facing a new world due to the COVID-19 pandemic and even this new world is changing rapidly in a way that we are unsure of. In this rough VUCA time, we are making decisions that are decisive for the future. Industries and SMEs are already largely affected worldwide, due to quarantines and lockdowns. Some sectors, under skill pressure, will, somehow, offer growth opportunities (e.g. IT & telecommunication, some Industry 4.0 pillars, health, logistics & supply chains). STEM universities will have to revise their strategies, graduate outcomes, programmes and better prepare their graduates to face the next coming economic crisis. STEM graduates will be faced with a new future, and employability and potential careers have already changed. STEM universities have no option but to adapt and prepare its students for the more ambiguous future with skills in decision-making. The urgent question is how can we prepare our STEM students for this new VUCA world?

In 2018 for the DAhoy project, Robin Karvo, Human Resources Consultant at Nokia France, recalled that "today's business world is changing more quickly than ever before: rapidly evolving markets, regulations, and technologies make it hard to see very far into the future. We all work in increasingly volatile, uncertain, complex and ambiguous business environments" (Karvo, 2018). This became even more real with the 2020 pandemic. Iceland faced a volcanic eruption in 2010 which affected other European businesses and trades. Indonesia regularly faces tsunamis with strong economic impacts. To look further, in May 2020, a French infectious disease specialist Professor, Geneviève Héry-Arnaud from Brittany INSERM research unit, co-signed an open letter to World Health Organisation on a potential disaster for the 2020 decade due to global warming, as melting ice may release new viruses and bacteria. Who knows today about the natural or economic future? We are now to be in human-centred society 5.0 with social problems which integrate cyberspace and physical spaces. Nevertheless, to continuously anticipate a VUCA future with a 5.0 perspective, a human-centred society that balances economic advancement with collaborative humans, nature and the resolution of social and societal problems is to consider, in 2020 and beyond.

Decisive decisions were made at the onset of the COVID-19. The future of society is likely to depend on what governments, professional sectors, and educational institutions decide to do. Therefore high expectations are placed on higher education, on how universities will prepare their STEM graduates for taking good decisions in VUCA-like situations, for working in the new emerging world and to take advantage of the new landscape of career opportunities. But how to better prepare these STEM graduates thanks to DAhoy guidelines?

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The 2020 COVID-19 will change the future of work and students' employability and careers. What can be learned from the covid-19 pandemic to improve VUCA training in Higher and VET education on Career Decision Making?

- **D1. Recognise and qualify the VUCA situation:** DAhoy/VUCA CDM training examples and good practices about the balance between social and economic approach and the #aftercareer.
 - Social before economic approach
 - Capacity of asking the question of the core business
 - It is before or after that we manage the crisis but not during.
- **D2. Analyse the VUCA situation:** DAhoy/VUCA CDM training examples and good practices concerning the executive committee when they recognise and qualify an abnormal situation.
 - Executive committee decisions to switch between social and 'business as usual '
- **D3. Make a judgement:** DAhoy/VUCA CDM training examples and good practices for the employee who must get to know himself in order to make the right decision for him at the right time
 - professions in tension.
 - The role of graduates
 - Renewed career opportunities or reorientation.
 - Entrepreneurship
 - new heroes positions
 - local solutions for the career and not global approach
- **D4. Face complexity:** DAhoy/VUCA CDM training examples and good practices for changing the individual way of mind of a way of making collectively to decide.
 - Cooperation instead of individual performance
 - Decision-making without stress
- **D5. Organise and implement actions:** DAhoy/VUCA CDM training examples and good practices to improve working conditions, the well-being of employees, inclusion and diversity in the logic of human capital, and in connection with corporate social responsibility. In the continuum YOU, these dimensions are provided by universities to sensitize the future managers.
 - Quality of relationships instead work relationship
 - Diversity instead traditional team building
 - Working for the future and rethink the work environment
- **D6. Taking responsibility:** DAhoy/VUCA CDM training examples and good practices. (i) For the employer, to take in the management of the career and to learn especially with new technology. (ii) For the management: the style of management, the respect of the balance between professional life and private life, to capitalise on lifelong training. (iii) For the companies, the culture with collective values and a societal and RH strategies with well-being.

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- VUCAized career
 - To learn throughout one's life and responsibility of lifelong training
 - Style of leadership based on empathy and calm instead of power
 - Balance Professional life / private life
 - Enterprise Culture and collective values on line with leadership
- **D7. Learning from experience:** DAHoy/VUCA CDM training examples and good practices for the future, especially in the numeric strategy because tomorrow will be improved by the struggles we're facing during today.
 - Work and Technology
 - Autonomy with reindustrialisation
 - Rationalisation
 - Break without competition, a new VUCA philosophy?
 - The technology solution but without increase of skills

It's important to hold a sense of optimism for the future, especially after a crisis. All the solutions we find during the crisis are good for the future. We learn about experience, even the experience is a difficult context. The commitments or the career opportunities, the learning we do today will improve the years to come. Each crisis will eventually pass and a new normal will emerge and there is plenty of reason to believe that the future will be bright.

How can curriculum structures and models be adapted to better support 5.0 future skills needs with university-industry collaborations beyond the 2020 pandemic in moving forward? Cooperation between academia and industry is beneficial to both parties. Academia can improve their curriculum and knowledge delivery whilst industry takes advantage of subjects developed by academia. Support structures are essential for enabling rapid external engagement. Transdisciplinary, multisector strategies are necessary when seeking to solve complex problems that threaten global public health and safety.

As a perspective, for the post COVID-19 period in higher and VET education, transversal skills reinforcement is more than needed, and now is a great opportunity for engineering education institutions to revise program outcomes and aim for V-shaped perspectives for their graduates. DAHoy breadth transferable courses and 'capsules' for VUCA exposure are a good start. V-shaped people are the kind that we need for the post-COVID-19, with a focus on careers and competency development, both across and up, and to grow tomorrow's workforce. Engagement with industry has always been a crucial requirement for technological universities when revising their strategies, programmes and preparing their graduates to support economic development since the 1st Industrial Revolution (Kloot and Rouvrais, 2017). University-industry collaboration will be critical to ensuring the recovery phases of both higher education and the economy. The 2020-like economic crisis at national or worldwide level will, however, require that higher educational institutions in engineering constantly revise, stimulate and even create new forms of collaboration, new models and processes, reactively rather than passively with systemic inertia.

Higher education as a whole needs to become adaptable, and move to the rapid pace of change in the environment. Higher education structures, processes and policies need to be revisited on a regular basis, and the institutional culture has to be conducive to embracing change, rather than be characterised by extreme bureaucracy and hierarchy, and upholding traditions which are not in tune with the present reality. It will also be important for higher education transitioning to a new

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norm to be able to integrate social and societal aspects, even natural fundamentals and values which are far too neglected, and to encompass the concrete experiences learned from each crisis, to ensure development as reflective practitioners (Schön and DeSanctis, 1986). DAhoy project tried to share some way of doing.

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DAHoy publications, September 2019 - June 2020

- **Decision-making skills and industry collaborations in preparing engineering students for a VUCA world: COVID-19 and beyond**
under preparation Spring 2020...
- **Career decision-making learning activities in STEM: An integrated capsule model earmarked for higher and VET educations**
N. Chelin, S. Rouvrais, M. Del Mare, and G. Matthiasdotir. In Proceedings of the 12th annual International Conference on Education and New Learning Technologies. Virtual conference, 6th-7th of July, 2020.
- **Co-orientation: A collaborative method to guide students' decision-making to a right first Job**
N. Chelin & S. Rouvrais. In Proceedings of the 12th annual International Conference on Education and New Learning Technologies. Virtual conference, 6th-7th of July, 2020.
- **An integrative framework for decision making in VUCA environments**
Roger Waldeck. Under submission 2020...
- **An alternative risk assessment routine for decision making: Toward a VUCA meter to assess the volatility, uncertainty, complexity and ambiguity of complex projects**
Thordur Vikingur Fridgeirsson, Bara Hlin Kristjansdottir and Helgi Thor Ingason. Book Chapter 4 in "Research on Project, Programme and Portfolio Management. Integrating Sustainability into Project Management". 13 pages. Springer, 2020
- **Interdisciplinarity & VUCA**
Waldeck R., Gaultier Le Bris S. and Rouvrais S.
Chapter 5 in ISTE book, "Methods and Interdisciplinarity" series, Volume 1, Modeling Methodologies in Social Sciences Set. Ed. G Waldeck. pages 99-116, December 2019.
- **Learning Methodologies for VUCA situations**
Gaultier Le Bris S., Rouvrais, S., and Waldeck R.
Chapter 6 in ISTE book, "Methods and Interdisciplinarity" series, Volume 1, Modeling Methodologies in Social Sciences Set. Ed. G Waldeck. pages 117-148, December 2019.

2017- August 2018 and September 2018 – June 2019 DAHoy publications can be found in the O1 and O2 reports respectively. All the publications descriptions are also available via the DAHoy website.

Contributors

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DAHoy project is an inter-institutional collaboration which includes a process in which parties (individuals or institutions) work together to achieve project goals. DAHoy knowledge is shared through regular open discussion during plenary meetings and Skype meetings. All DAHoy partners share the same values and ideologies around the project objectives. This DAHoy report, as project year three 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.

More precisely, there is generally a 'leader' of the collaboration of this 3rd report:

- At IMT Atlantique, Siegfried Rouvrais
- At Reykjavik University, Þórður Víkingur Friðgeirsson

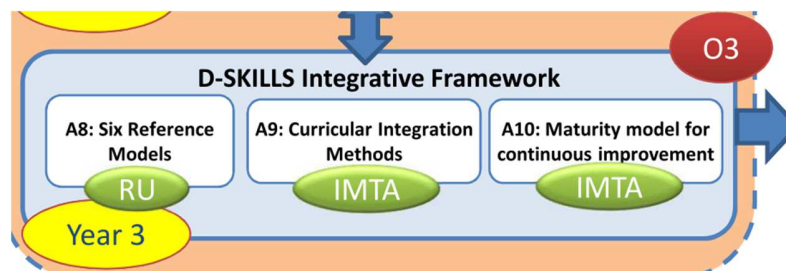


Figure. DAHoy Year 3 activities and institution leadings.

A collaborative project cannot exist without the active implication on several stakeholders in the partnership. Several DAHoyers collaborated for this third DAHoy report, formally as reference model producers or during informal discussion in project meetings, or simply as reviewers of some parts of this report. They include in alphabetical order:

- At City of Glasgow College: Katie Jordan (CoGC), Matthew Stewart (CoGC);
- At Ecole Navale: Sophie Gaultier Lebris (EN);
- At FREREF: Axel Joder (FREREF);
- At the Fundació Universitat-Empresa de les Illes Balears (FUEIB): Mari Agredano (FUEIB), Maria Del Mar Socias Camacho (FUEIB), Lluís Tudela (FUEIB);
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