MACHINA

O2-T1: Methodology for the validation of the MACHINA learning outcomes

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1 INTRODUCTION

Machine Learning (ML) is a subset of Artificial Intelligence (AI) that has gained substantial prominence in diverse economic & social realities, having become the basis for a series of technological developments such as automated translation systems, medical image analysis, and virtual assistants. ML was born from pattern recognition but has evolved to refer to the use of data & learning algorithms to produce models, predict outcomes and make decisions with minimum human intervention.

MACHINA is an Erasmus+ KA2 project, which aims to tackle this ML skill deficit by increasing the relevance of Continuing & Initial VET provision in the sector, to assure that the existing & future ICT workforce will have the ML specific competences & transversal skills required to respond to modern workplace requirements and succeed in a competitive, fast-growing field. The project will also make available transnational educational materials in the form of OERs, to ensure wide adoption and support VET provision in a cost-effective, flexible way.

This methodology seeks to provide MACHINA partners with appropriate tools & guidelines validating the learning outcomes defined as part of O1 activities, and divided into 6 modules:

1. ML essentials for ICT professionals
2. Mathematics foundations (Probability, Statistics, Analysis, Linear algebra, Computing theory)
3. ML Algorithms, programs and protocols
4. Deep Learning (Advanced)
5. Communicating the merits, challenges and implications of ML technology to customers and within own organisation
6. Legislation, Ethics, Project management related to ML

Validation procedures in Europe and worldwide differ due to different political, economic, legal circumstances and to different national and regional strategies (UNESCO, 2013; European Commission/CEDEFOP/ICFI, 2014). Nevertheless, in the development of validation procedures common features can be seen: The European Centre for the Development of Vocational Training (CEDEFOP) has monitored the development of validation procedures of non-formal and informal learning in Europe for more than 15 years. CEDEFOP (2009) and develops guidelines and recommendations for validation based on an intensified exchange of experiences of 22 countries in Europe. These European guidelines are relevant for the basic structure of validation. They stipulate an equal right for access to validation for everyone. According to the guidelines, the institutions and procedures must be clear and individual tasks must be assigned for a successful implementation of validation procedures.

The COUNCIL RECOMMENDATION of 20 December 2012 on the validation of non-formal and informal learning recognizes the conflict between formal and non-formal/ informal learning and seeks

to promote a more systematic approach to 'validation', to increase the visibility and value of learning taking place outside formal education and training systems. In the context of this Recommendation, validation is defined as:

> (i) **validation** means a process of confirmation by an authorised body that an individual has acquired learning outcomes measured against a relevant standard and consists of the following four distinct phases:
>
> 1. IDENTIFICATION through dialogue of particular experiences of an individual;
>
> 2. DOCUMENTATION to make visible the individual's experiences;
>
> 3. A formal ASSESSMENT of these experiences; and
>
> 4. CERTIFICATION of the results of the assessment which may lead to a partial or full qualification;"

As **CEDEFOP European guidelines for validating non-formal and informal learning explains, (2015)** "*these phases are mixed and balanced in different ways, reflecting the particular purpose of each validation arrangement. When working towards a formal qualification, the robustness and credibility of the assessment stage are crucial.*

In other cases, for example in relation to voluntary work, more emphasis is given to identification and documentation, less to formal assessment and certification. However, the four phases are likely to be present in all validation arrangements.

The purpose of validation is to produce proof of learning, potentially to be exchanged into future learning and/or work. This requires identification, documentation and assessment of the learning in question to refer to an agreed and transparent reference point or standard. In validation for formal qualifications, official standards used by the education and training system/institution will largely define the requirements of the validation process. […] Overall, the extent to which validation process outcomes can be transferred and exchanged very much depends on the extent to which the resulting document, portfolio, certificate or qualification is trusted by external parties and stakeholders, which reflects the way the four phases have been designed and carried out."

The **COUNCIL RECOMMENDATION of 22 May 2017 on the European Qualifications Framework for lifelong learning** provides that:

> "*(j)'**validation of non-formal and informal learning**' means the process of confirmation by a competent authority that an individual has acquired **learning outcomes acquired** in non-formal and informal learning settings **measured against a relevant standard** and consists of the following four*

distinct phases: identification through dialogue of particular experiences of an individual, documentation to make visible the individual's experiences, a formal assessment of those experiences and certification of the results of the assessment which may lead to a partial or full qualification"

The EQAVET (European Quality Assurance in Vocational Education and Training) Glossary definition of validation specifies: "*Refers to what is assessed and how well this corresponds with the behaviour or construct to be assessed. In the case of 'site validity' it involves assessments that intend to assess the range of skills and knowledge that have been made available to learners in the classroom context or site. High 'system validity' involves assessments that intend to assess an often narrower range of skills and knowledge, deemed essential by the particular government body or system. Current validity theorising incorporates concerns about fairness and bias, and reflects similar understandings of the social basis of assessment. Validity is not simply the way in which a test functions, but depends on what it is used for and the interpretation and social consequences of the results. Thus, an essential part of validity is the concern with whether the inferences made from the results of an assessment are fair to all those who were assessed.*"

2 STAGES OF VALIDATION PROCESS IN EUROPEAN CONTEXT

Phase 1: Identification

Identification forms the basis of the process of validating non-formal and informal learning. In this phase the individual´s competencies and learning outcomes are recorded and made visible. Candidates identify and analyse their individual and professional competences and their educational background. These are being documented e.g. in a portfolio that includes data, facts and proof pertaining to a certain professional qualification profile. Included here are formal education and non-formal education as well as informal learning.

This stage is crucial as learning outcomes differ from person to person and will have been acquired in various contexts: at home, during work or through voluntary activities. For many, discovery and increased awareness of own capabilities is a valuable outcome of the process.

Phase 2: Documentation

Documentation is the next phase in the validation process and involves provision of evidence of the learning outcomes acquired. This can be carried out through the 'building' of a portfolio that tends to include a CV and a career history of the individual, with documents and/or work samples that attest to their learning achievements. Validation needs to be open to various evidence types, ranging from written documents to work samples and demonstrations of practice.

A structured documentation is the outcome of the phase of identification and the basis for the assessment. Experts appraise the documentation, e.g. as portfolio, interview the candidate and provide an assessment at the end. On the one hand, they check if the submitted proofs are relevant, reliable and significant and on the other hand, they determine if and how the scope and the level of the professional competence and the educational background fulfil the requirements for the profession or degree programme. The assessment is being made from a holistic point of view and is suitable for adults.

This evidence must provide sufficient insight into the learning outcomes acquired: simply listing job-titles or positions will not be enough. The portability of evidence is crucial and requires some degree of coordination at national and European level.

Phase 3: Assessment

Assessment is the stage in which an individual's learning outcomes are compared against specific reference points and/or standards. This can imply evaluation of written and documentary evidence but might also involve evaluation of other forms of evidence. This phase depends on the standard or reference point used. The shift to learning-outcomes-based standards is generally considered to benefit validation. Focusing on what a learner knows, understands and is able to do, a learning-outcomes based assessment

is not obliged to consider particular input-factors (such as duration or location of learning). As validation is about capturing diverse individual learning experiences, in case of non-formal and informal learning, assessment tools need to be designed to capture and assess the learning specific to each individual and the context in which this learning took place. This is different from formal learning where assessment tools can be applied across larger cohorts of students and where less priority is given to the particular needs of subgroups or individuals. The individual specificity of learning outcomes concerned may require more than one tool, for example, a combination of written tests and practical challenges. Tools will frequently need to apply practical demonstrations, simulations or gathering of evidence from past practices

As defined by ISCED 2011 - non-formal education is education that is institutionalised, intentional and planned by an education provider. The defining characteristic of non-formal education is that it is an addition, alternative and/or complement to formal education within the process of lifelong learning of individuals. It is often provided in order to guarantee the right of access to education for all. It caters to people of all ages but does not necessarily apply a continuous pathway structure; it may be short in duration and/or low-intensity; and it is typically provided in the form of short courses, workshops or seminars. Non-formal education mostly leads to qualifications that are not recognised as formal or equivalent to formal qualifications by the relevant national or sub-national education authorities or to no qualifications at all. Nevertheless, formal, recognised qualifications may be obtained through exclusive participation in specific non-formal education programmes; this often happens when the non-formal programme completes the competencies obtained in another context.

Informal learning is defined as forms of learning that are intentional or deliberate, but are not institutionalised. It is consequently less organized and less structured than either formal or non-formal education. Informal learning may include learning activities that occur in the family, workplace, local community and daily life, on a self-directed, family-directed or socially-directed basis. Like formal and non-formal education, informal learning can be distinguished from incidental or random learning.

Assessment shall be done according to the regulations in force by the authorized bodies, authorities, education providers, etc, as the case may be.

Phase 4: Certification

The final phase of validation, certification is being issued pertaining to the requirements and standards of the profession or degree programme. The chambers or other certifying institutions issue a report or certify the requirements for the profession or degree programme.
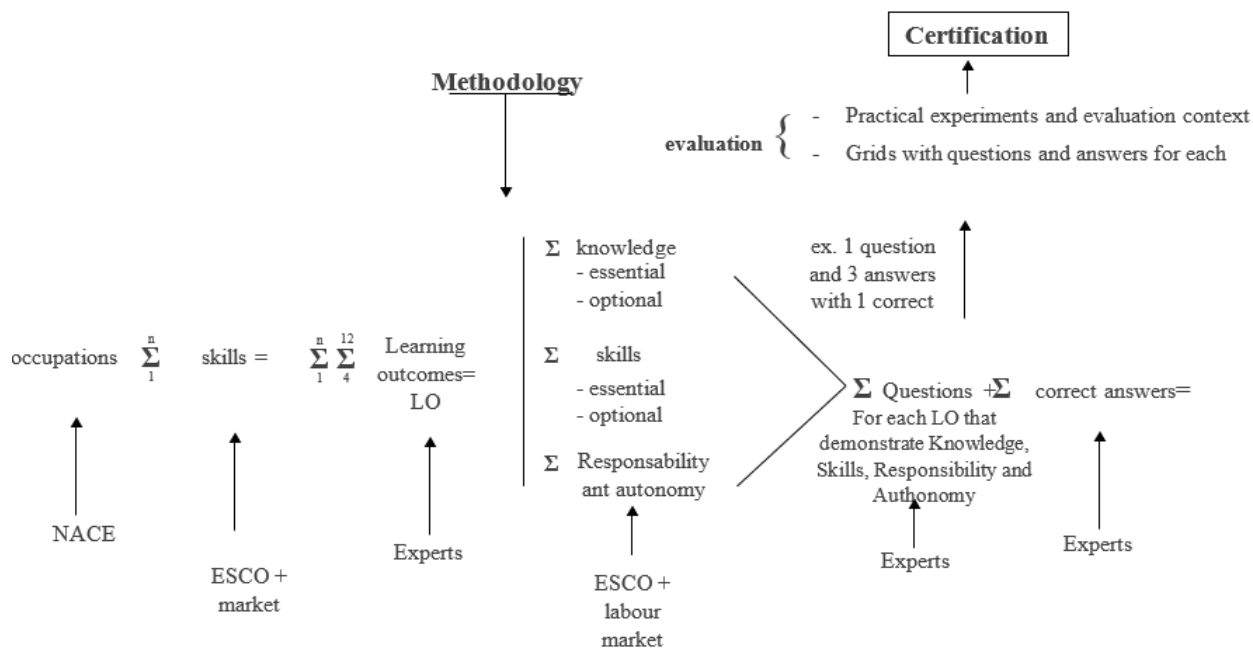
This can take different forms, but is commonly the award of a formal qualification (or part-qualification). In enterprises or economic sectors, certification may also involve issuing a licence allowing the individual

to carry out specific tasks. Validation reaching the stage of certification requires a summative assessment officially confirming the achievement of learning outcomes against a specified standard. It is crucial that this process is managed by a credible authority or organisation. The value – or the currency – of a certificate or qualification acquired through validation largely depends on the legitimacy of the awarding body or authority. The use of summative approaches for validating non-formal and informal learning needs to be strongly linked – preferably integrated – into national qualifications systems.

3 ASSESSMENT

The validation process

Methodology

$$\text{occupations } \sum_{1}^{n} \quad \text{skills} = \sum_{1}^{n}\sum_{4}^{12} \quad \begin{array}{c}\text{Learning}\\ \text{outcomes=}\\ \text{LO}\end{array}$$

Σ knowledge
  - essential
  - optional

Σ skills
  - essential
  - optional

Σ Responsability
   ant autonomy

ex. 1 question
and 3 answers
with 1 correct

Σ Questions $+\Sigma$ correct answers=
For each LO that
demonstrate Knowledge,
Skills, Responsibility and
Authonomy

evaluation {
- Practical experiments and evaluation context
- Grids with questions and answers for each

Certification

NACE

ESCO +
market

Experts

ESCO +
labour
market

Experts

Experts

= **Evaluation and certification standard** for formal or informal.

3.1 Assessment of learning outcomes

Characteristics of the assessment of learning outcomes obtained in non-formal / informal learning contexts:

- It is a type of summative evaluation

The summative approach to assessment and validation explicitly aims at formalizing and certifying learning outcomes and is linked and integrated into institutions and bodies authorized to award certifications.

- It is focused on the individual

Identifying and writing learning outcomes places the individual at the centre of the entire process - what he knows, understands and can do. The learning outcomes-based approach the contextual flexibility in which the candidate can best demonstrate his or her level of competence is what is really important.

- Uses combined assessment methods: assessment of theoretical knowledge and assessment of practical knowledge and skills.

3.2 Assessment tools

(1) Assessment of theoretical and practical knowledge: written test (different types of items), direct questions - interview, structured dialogue.

(2) The portfolio can be considered a method of documentation, but can also be considered a tool for evaluating learning outcomes - practical component (work done / open educational resources / presentation of a project, etc.).

(3) Assessment of practical skills, level of responsibility and autonomy: simulation, direct observation in real working conditions, oral questions (verification conversation).

DESCRIPTION OF ASSESSMENT TOOLS AND INSTRUMENTS

Assessment method	Assessment instrument	Description
Written evaluation	Witten test	• Written tests are assessment tools specific to the formal education system, but have the advantage of being familiar, socially recognized as valid and reliable.
Oral evaluation (supporting the practical evaluation)	Direct questions (verification discussion)	• Direct questions have a "supporting function", which allows further exploration, not being a main tool for obtaining learning outcomes evidence obtained in non-formal and informal learning contexts. • The tool is used to clarify issues related to the depth of learning outcomes. • When used at the beginning of the evaluation process, it is a screening tool to check if other evaluation methods are better suited to the purpose • Direct questions may have a higher degree of validity than written tests, as misunderstandings in the formulation of items can be avoided. However, they are less reliable than tests, and also less accurate.
	Debate	The debate gives the student the opportunity to demonstrate the depth of his knowledge and communication skills.

Assessment method	Assessment instrument	Description
		This assessment tool does not have a standard format, being indicative for assessor.
Practical evaluation	Simulation	• It involves creating the situation / context that meets all the criteria of the real life scenario, in order to carry out the activities specific to an occupation. • The higher the level of "realism" of the simulation, the more efficient the evaluation. • The simulation can solve some of the "problems" of the "Observation in real working conditions" tool, because it places the candidate in various contexts, increasing the credibility of the evaluation process. • The reliability, validity and correctness of this method are considered high.
	Observation (in real work situations)	• This tool allows the extraction of evidence of an individual's learning outcomes, while performing daily tasks at work - in real time. • Observation in real working conditions has the advantage that it allows the evaluation of several learning outcomes simultaneously. • This tool has a high degree of validity and provides access to skills that are difficult to capture by other methods / tools.
	Portfolio	• This tool is, in fact, a mixture of methods and tools used in consecutive stages in order to produce a coherent set of documents or working samples, which support the declared level of learning outcomes acquired by a student, skills and competences, in different ways. • The portfolio is one of the most complex and frequently used methods of documenting learning outcomes evidence for validation purposes. • The Portfolios aim to overcome the risk of subjectivity by introducing a mix of tools to extract evidence of learning outcomes, the skills and capacity of individuals and incorporating assessments from third parties.

Source: adaptation after (Cedefop (2015). *European guidelines for validating non-formal and informal learning*. Luxembourg: Publications Office.)

4 RECOGNITION AND TRANSFER OF LEARNING OUTCOMES

4.1 Context

The European Credit System for Vocational Education and Training (ECVET) supports the valorisation of learning mobility because:

• The learning outcomes approach ensures a better understanding and comparability of qualifications and learning achievements across countries. When using ECVET for learning mobility, the learning outcomes that the learner is expected to achieve abroad are clearly agreed by the partner institutions and stated in a Learning Agreement. Consequently everyone, including the home institution, the host institution and the learner; have a shared understanding of the objectives of the mobility.

Following the participation in appropriate learning activities, learners acquire the expected knowledge, skills and competence and they are assessed on what they have achieved. The learning outcomes that they have achieved abroad are documented in a transcript of record and thus made visible.

The validation and recognition of learning outcomes are in the framework of mutual trust among partner institutions.

Individuals' mobility periods are set in a broader framework of agreements. Partner institutions set the conditions for smoother exchanges of learners and develop mutual trust. They also agree to the conditions under which learners' credit (i.e. assessed learning outcomes) achieved abroad will be validated and recognised. These agreements are formalised in Memoranda of Understanding.

ECVET can accommodate different forms of validation and recognition of learners' learning outcomes, such as:

• Awarding credit for the unit(s) of learning outcomes concerned.

• Exemption from an assessment or its part.

• Transcription of the learning outcomes achieved abroad in learners' transcripts of record.

• Awarding additional credit to what s/he would have normally achieved.

Evaluation (of the mobility experience): After the mobile learner has returned to the home institution ('ECVET after mobility'), the person in charge checks whether the learning outcomes achieved are in line with the Learning Agreement. If this is the case, the learner's credit achieved abroad is validated and recognised. After all three phases (before, during and after) of the mobility process have been completed, the whole process needs to be evaluated. The crucial question is whether the main aim of using ECVET for geographical mobility has been achieved for the specific mobile learner, in other words whether it was

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possible to recognise the knowledge, skills and competence he or she has acquired abroad. If the credit achieved abroad cannot be (fully) validated and recognised as planned, the procedures put in place before, during and after the mobility need to be evaluated and reviewed to ensure that for future mobility exchanges credit can be recognised. Regardless of whether recognition has been achieved or not, evaluation and collection of feedback is recommended. This will help identify potential areas for improvement (for example, regarding the time spent on specific issues, the instruments used, or the quality assurance procedures implemented). All actors involved in the mobility period (in particular, host and home institution and the mobile learner) should also be involved in the evaluation process to ensure that all perspectives can be taken into account in the review of the ECVET mobility process.

4.2   Process

Background

Article 1

(1) The European Credit System for Vocational Education and Training shall be used to facilitate transnational mobility and the recognition of learning outcomes in vocational education and training and in lifelong learning.

(2) The credit is a conventional unit used to calculate the volume of work done by the student in a given period of time to achieve certain purposes and skills. The Credit is a tool to ensure the quality of training.

Article 2

This Methodology is based the User's guide European credit system for vocational education and training ECVET / SECEFP developed by the European Commission

Awarding credits in initial and continuing vocational training

Article 3

(1) The credit system for vocational education and training is used for initial vocational training, vocational training for adults and for the validation of skills acquired in non-formal or informal learning contexts, for qualifications corresponding to qualification levels 1 - 5 of the National Qualifications Framework (NQF), in accordance with the European Credit System for Vocational Education and Training.

(2) The principles of the credit system for education and training are:

a) use of learning outcomes;

b) the use of unitary procedures for evaluating, validating and recognizing learning outcomes and their associated credits.

(3) Vocational training credits represent the total learning outcomes acquired by a person during a vocational training program, used to indicate progress and the completion of a training program leading to a qualification.

Article 4

The transferable credit system for education and training is used for lifelong learning in the following contexts:

a) students who wish to change their vocational training program, within the initial vocational training system, for the same qualification level;

b) students who want to change their vocational training program, within the system of continuous vocational training, for the same level of qualification;

c) adults who want to improve their qualification or obtain a new qualification and already have credits for learning outcomes that are awarder by the specialization program or in the new qualification;

d) individuals who already have a qualification, but need, or wish to obtain another qualification which contains learning outcomes specific to the qualification they already hold;

e) young people who have dropped out of education and training and who want to return to school after 1-2 years of interruption; using credits for learning outcomes they have accumulated in the past;

f) individuals who practice a profession without having a qualification, but who wish to obtain a qualification in order to progress in their career; by recognizing credits for previously acquired learning outcomes and validating learning in non-formal or informal contexts.

Article 5

(1) The recognition of credits is carried out only by educational institutions or providers of accredited continuing vocational training programs, according to the law.

(2) The recognition of credits for education and vocational training is applied for the same level of NQF qualification, under the conditions of observing some unitary criteria regarding the evaluation of the associated learning results.

(3) Recognized credits for education and training may be accumulated in order to complete a vocational training program leading to a qualification.

4. Recognized appropriations for education and training may be transferred and integrated into a vocational training program leading to a qualification.

(5) The recognition and transfer of credits for education and professional training shall be made at the request of the interested person.

(6) Educational institutions / providers of continuing vocational training programs shall designate the person (s) responsible for the recognition and transfer of credits.

Article 6

(1) Vocational training credit points are the numerical expression of the importance of a unit of learning outcomes in relation to a qualification.

(2) Credit points shall be awarded for both a full qualification and its components.

(3) The number of credit points awarded to a full qualification shall be determined by reference to the duration of the vocational education and training program, expressed in number of hours, leading to the qualification.

(4) One credit point corresponds to a number of 30 hours of education and training, out of which 20 hours for teaching learning activities and 10 hours for individual learning activities.

(5) The number of credit points for the components of a qualification shall be allocated according to the number of training hours necessary to acquire the component unit, by reference to the time agreement established in par. (4).

(6) By convention, for one year of formal training, day course, the number of credit points is 60.

Using the credit system for education and training for geographical mobility

Article 7

(1) In order to ensure transparency and fairness in promoting the transferability of credits for vocational education and training between education and training providers across Europe, the European system of credits for education and training ECVET shall be used.

(2) The granting of credits for education and vocational training for geographical mobility is made on the basis of the learning outcomes acquired during the mobility, evaluated and certified at the end of the mobility period.

Article 8

(1) Given the distinct formative purpose of qualification levels, the transfer of appropriations may be effected only within the same qualification and for the same qualification level.

(2) The providers of education and professional training may elaborate their own regulations for the transfer of credits, based on the provisions of the present methodology.

Supporting documents for student mobility

Article 9

(1) The transfer and accumulation of credits shall be facilitated by the use of documents provided for by the European Credit System for Vocational Education and Training, ECVET.

(2) The supporting documents include the Memorandum of Understanding, the Learning Agreement / Training Program and the commitment to quality used in the case of Erasmus mobilities and the Europass Supplement.

(3) The Learning Agreement / Training Program and the quality commitment are concluded between the sending institution / provider of education and training and the host institution / provider of education and training.

(4) The Learning Agreement / Training Program and the quality commitment guarantee the transfer of credits obtained during the mobility periods.

(5) The structure of the Learning Memorandum is presented in Annex no.1

(6) The structure of the Learning Agreement is presented in Annex no.2

Article 10

(1) The awarding of credits is made by the provider of education and professional training where the student / trainee is enrolled.

(2) The credits are granted automatically, at the end of the mobility period and the return to the country.

(2) In order to transfer the credits acquired during the mobility periods, the educational institution / provider of vocational education and training establishes the person / persons responsible for the recognition and transfer of credits.

(3) Credits are granted only in the situation where the student / learner has fully acquired the learning outcomes / competencies established in the Learning Agreement / Training Program and the quality commitment concluded prior to the mobility.

Awarding credits by validating professional skills acquired in non-formal or informal learning contexts

Article 11

(1) Credit points may also be awarded to qualifications acquired through the validation of professional competences acquired in non-formal or informal learning contexts.

(2) In order to be able to award credit points to a qualification acquired through the professional skills validation process, it is necessary to have a formal training program as a reference.

(3) Any qualification, including its component units, acquired through the validation of professional competencies, shall receive the same number of credit points as the reference.

Article 12

(1) The recognition and awarding of credits by validating the professional competences acquired in non-formal or informal learning contexts shall be performed by assessment centers for professional competences, under the conditions of observing the provisions of the present methodology.

(2) The professional competence assessment centers shall establish the person / persons responsible for the recognition and granting of credits, among the competence evaluators, registered in the national register of evaluators.

(3) The granting of credits for vocational education and training is made at the written request of the interested person.

Context

Article 13

Validation starts with the identification of knowledge, skills and competence acquired where the individual becomes increasingly aware of prior achievements. This stage is very important as learning outcomes differ from person to person and will have been acquired in various contexts: at home, during work or through voluntary activities. The methods and approaches for identifying this non-standardized character of non-formal and informal learning must be 'open' and not be designed in ways which narrow down the range of knowledge, skills and competences that may be considered. While the identification phase may be supported by the use of standardised ICT tools allowing self-assessment, this stage will frequently require active involvement of advisers and counsellors able to enter into a dialogue with the candidate and direct him/her to appropriate options and tools, by means of interviews and dialogue-based approaches. In this initial phase the individual must be made aware of the costs and benefits of validation, compared to further education and training.

5 INDICATIVE FRAMEWORK FOR THE VALIDATION OF MACHINA LEARNING OUTCOMES

5.1 General Principles

Criteria and specifications for evaluation/examination centres

Article 14

*European guidelines for validating non-formal and informal learning – 2018*While it is most commonly found within education and training, making it possible for individuals to acquire a formal qualification on the basis of non-formal and informal learning, validation is also carried out by several institutions and stakeholders outside education and training: labour market authorities, economic sectors, enterprises and voluntary organisations.

The validation process relies on formative and summative assessment defined herein as:

(a) formative approaches to assessment aim to provide feedback to the learning process or learning career, indicating strengths and weaknesses and providing a basis for personal or organisational improvement. Formative assessment fulfils a very important role in numerous settings ranging from guidance and counselling to human resource management in enterprises;

(b) summative approaches to assessment and validation aim explicitly at formalising and certifying learning outcomes and are linked to, and integrated into, institutions and bodies authorised to award qualifications.

Examination procedure details (duration, pre-requisites for applicants, equipment/software needed)

Article 15

The examination shall be conducted online through platforms, portals and other appropriate ICT tools, depending on the software supporting the VOOC content. These include self-assessment, peer-assessment, weekly quizzes and the final exam marked multiple-choice quizzes, etc.

Indicative performance criteria for the defined learning outcomes

Article 16

The performance criteria shall be compliant with the formal education applicable by the laws in force, and ISCED 2011 principles.

Assessment methods (e.g., written, oral, or/practical)

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Article 17

There are several methods that aim to extract evidence (tests and examinations, conversational methods, declarative methods, observations, simulations, evidence extracted from work) and for documenting and presenting evidence (such as 'live evidence', CVs, third party declarations and portfolios).

Peer assessment, i.e. the assessment of one's skills by peers, can also be used with digital tools in the context of validation. Conceptually, it is an educational arrangement where learners judge a peer's product or performance quantitatively and/or qualitatively. Products to be assessed may include written texts, oral presentations, portfolios, test performance, or other skilled behaviours.

The assessment methods shall focus on written theoretical and practical test, conducted online.

Assessment tools (e.g., MCQ, simulation, observation, debate)

Article 19

Digitalisation presents opportunities in areas such as non-formal learning and e-learning, and digital technologies are already used for skills obtained through nonformal and informal learning.

Digital self-assessment tools and simulation tests can, where possible, be used as part of the assessment process. Such tools can be more or less standardised, include different forms of assessment (self assessment or external assessment) and might be combined with face-to-face guidance sessions.

This can imply evaluation of written and documentary evidence but might also involve evaluation of other forms of evidence.

Focusing on what a learner knows, understands and is able to do, a learning-outcomes based assessment is not obliged to consider particular input-factors (such as duration or location of learning). This makes it easier to reflect and respect individual variation in learning careers. Many of the tools and methods used for assessing non-formal and informal learning will be based on, or similar to, those used in formal education and training.

As validation is about capturing diverse individual learning experiences, assessment tools need to be designed to capture and assess the learning specific to each individual and the context in which this learning took place. The individual specificity of learning outcomes concerned may require more than one tool, for example, a combination of written tests and practical challenges. Tools will frequently need to apply practical demonstrations, simulations or gathering of evidence from past practices.

Scoring and passing thresholds

Article 20

The students must obtain at least half of cumulated points resulted from theoretical and practical tests (specific competence tests and other chosen methods) in order to pass the course.

Type of certification to be obtained

Article 21

Depending on the legislation in force in each partner country, the type of certification shall be agreed upon by the partners. It can take the form of a formal certificate leading to the qualification recognized at national and/or international level or just a participation certificate (particularly in case of non-formal and informal contexts).

At the end of the VET Machine learning course, the student shall receive a certificate with a number of VET credits corresponding to learning outcomes acquired at the end of each Learning Unit.

6 MACHINA VALIDATION FRAMEWORK

<table>
<tr><td colspan="2" align="center">MACHINA VALIDATION FRAMEWORK</td></tr>
<tr><td>Examination Body</td><td>Third party certification organization (e.g., ECQA, OCNNI)</td></tr>
<tr><td>Examination duration</td><td>4-6 hours</td></tr>
<tr><td>Prerequisites for applicants</td><td>

Documentation (1)
- Certificate of completion of the MACHINA curriculum, as delivered in a classroom-based environment
  or
- Certificate of completion of the MACHINA VOOC
  or
- Certificate of completion of a course that includes at least 3 modules of the MACHINA curriculum

Documentation (2)
- Curriculum vitae

Documentation (3)
- Completed application form

</td></tr>
<tr><td>Prior Knowledge</td><td>Python Language</td></tr>
<tr><td>Assessment method</td><td>

- Written: 70%
- Practical: 30%

</td></tr>
<tr><td>Assessment tools</td><td>

- Multiple Choice Questions
- Observation (via videos)
- Simulation
- Evidence/results extracted from programming practical work

</td></tr>
<tr><td>Modules</td><td>

- Module 1: ML essentials for ICT professionals
- Module 2: Mathematical Foundations
- Module 3: ML Algorithms, Programs and Protocols
- Module 4: Deep Learning
- Module 5: Communicating the merits, challenges and implications of Machine Learning technology to customers and within own organisation
- Module 6: Legislation, Ethics, Project Management related to ML

</td></tr>
<tr><td>Main Learning Outcomes</td><td>

- Know ML characteristics and different algorithms.
- Understand the concept behind ML and how to detect patterns from data.
- Identify different types of applications that use the ML algorithms.
- Know the mathematical concepts required for writing programs and algorithms for ML and AI
- Use programming languages for the implementation of machine learning algorithms.

</td></tr>
</table>

	• Define foundational machine learning models • Select suitable ML model for a given problem • Develop/Implement ML models using programming languages. • Understand deep neural network architecture. • Assess the potential of deep learning in different applications such as natural language processing, computer vision, or recommendation systems. • Understand the EU law and regulations for AI and ML applications. • Identify different types of bias in AI and their consequences. • Know the project management requirements and the lifecycle for AI applications. • Adapt messages to the diverse needs of individuals, groups and contexts • Differentiate between various approaches of communicating issues • Select creative and appropriate modalities and technologies to accomplish communicative goals • Present messages in multiple communication modalities and contexts
Performance levels	• **Basic**: Basic knowledge of facts, principles, processes and general ML concepts • **Intermediate**: Factual and theoretical knowledge and a range of cognitive and practical skills required to generate ML enabled solutions to specific contexts • **Advanced**: Comprehensive, specialized, factual and theoretical knowledge and a comprehensive range of cognitive and practical skills required to develop creative ML enabled solutions to specific contexts and problems
Performance criteria	Description of the minimum level of performance (basic, intermediate or advanced) a participant must demonstrate for each learning outcome to be assessed as competent.
Scoring/Passing thresholds	To pass a learning element (module), participants need to respond correctly to 66% of all element questions. In order to obtain the certificate, participants need to reach the passing threshold in all learning elements
Type of certification to be obtained	Professional Certificate in ML methods This certificate will act as an official testimonial of relevant skills acquisition, to be used as evidence in the labour market but also as part of a learner's process towards the completion of a VET qualification on Machine Learning

7 ANNEX 1

Memorandum of Understanding

Draft version

'File code' of the Memorandum of Understanding (optional)

text here

1. Objectives of the Memorandum of Understanding

The Memorandum of Understanding[1] (MoU) forms the framework for cooperation between the competent institutions. It aims to establish mutual trust between the partners. In this Memorandum of Understanding partner organisations mutually accept their respective criteria and procedures for quality assurance, assessment, validation and recognition of knowledge, skills and competence for the purpose of transferring credit.

Are other objectives agreed on? Please tick as appropriate	☐ No ☐ Yes – these are: please specify here

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[1] *For more information and guidance on the establishment of a MoU please refer to the ECVET User's Guide: 'Using ECVET for geographical mobility (2012) - Part II of the ECVET Users' Guide - Revised version – including key points for quality assurance' – available at: http://www.ecvet-projects.eu/Documents/ECVET_Mobility_Web.pdf*

2. Organisations signing the Memorandum of Understanding

Organisation 1

Country	text here
Name of organisation	text here
Address	text here
Telephone/fax	text here
E-mail	text here
Website	text here
Contact person	Name: text here
	Position: text here
Telephone/fax	text here
E-mail	text here

Organisation 2

Country	text here
Name of organisation	text here
Address	text here
Telephone/fax	text here
E-mail	text here
Website	text here
Contact person	Name: text here
	Position: text here
Telephone/fax	text here
E-mail	text here

Organisation 3 (remove table if not necessary)

Country	text here
Name of organisation	text here
Address	text here
Telephone/fax	text here
E-mail	text here
Website	text here
Contact person	Name: text here
	Position: text here
Telephone/fax	text here
E-mail	text here

Organisation 4 (remove table if not necessary)

Country	text here
Name of organisation	text here
Address	text here
Telephone/fax	text here
E-mail	text here
Website	text here
Contact person	Name: text here
	Position: text here
Telephone/fax	text here
E-mail	text here

Organisation 5 (remove table if not necessary)

Country	text here
Name of organisation	text here
Address	text here
Telephone/fax	text here
E-mail	text here
Website	text here
Contact person	Name: text here
	Position: text here
Telephone/fax	text here
E-mail	text here

Organisation 6 (remove table if not necessary)

Country	text here
Name of organisation	text here
Address	text here
Telephone/fax	text here
E-mail	text here
Website	text here
Contact person	Name: text here
	Position: text here
Telephone/fax	text here
E-mail	text here

add more tables if necessary – remove page if not necessary

3. Other organisations covered by this Memorandum of Understanding (if appropriate)

Explanatory note:

For MoUs established within a broader context (such as agreements set up by sector based organisations, chambers, regional or national authorities) a list of organisations (VET providers, companies, etc.) who are able to operate in the framework of the MoU can be added. This list can consist of their names or it can refer to the type of VET providers. The list can be included as an annex.

text here remove page if not necessary

4. The qualification(s) covered by this Memorandum of Understanding

Qualification 1

Country	text here
Title of qualification	text here
EQF level (if appropriate)	text here
NQF level (if appropriate)	text here
Unit(s) of learning outcomes for the mobility phases (refer to enclosure in the annex, if applicable)	text here
Enclosures in annex - please tick as appropriate	☐ Europass Certificate Supplement ☐ The learning outcomes associated with the qualification ☐ Description of the unit(s) of learning outcomes for the mobility ☐ Other: please specify here

Qualification 2

Country	text here
Title of qualification	text here
EQF level (if appropriate)	text here
NQF level (if appropriate)	text here
Unit(s) of learning outcomes for the mobility phases (refer to enclosure in the annex, if applicable)	text here
Enclosures in annex - please tick as appropriate	☐ Europass Certificate Supplement ☐ The learning outcomes associated with the qualification ☐ Description of the unit(s) of learning outcomes for the mobility ☐ Other: please specify here

Qualification 3 (remove table if not necessary)

Country	text here
Title of qualification	text here
EQF level (if appropriate)	text here
NQF level (if appropriate)	text here
Unit(s) of learning outcomes for the mobility phases (refer to enclosure in the annex, if applicable)	text here
Enclosures in annex - please tick as appropriate	☐ Europass Certificate Supplement ☐ The learning outcomes associated with the qualification ☐ Description of the unit(s) of learning outcomes for the mobility ☐ Other: please specify here

Qualification 4 (remove table if not necessary)

Country	text here
Title of qualification	text here
EQF level (if appropriate)	text here
NQF level (if appropriate)	text here
Unit(s) of learning outcomes for the mobility phases (refer to enclosure in the annex, if applicable)	text here
Enclosures in annex - please tick as appropriate	☐ Europass Certificate Supplement ☐ The learning outcomes associated with the qualification ☐ Description of the unit(s) of learning outcomes for the mobility ☐ Other: please specify here

Qualification 5 (remove table if not necessary)

Country	text here
Title of qualification	text here
EQF level (if appropriate)	text here
NQF level (if appropriate)	text here
Unit(s) of learning outcomes for the mobility phases (refer to enclosure in the annex, if applicable)	text here
Enclosures in annex - please tick as appropriate	☐ Europass Certificate Supplement ☐ The learning outcomes associated with the qualification ☐ Description of the unit(s) of learning outcomes for the mobility ☐ Other: please specify here

Qualification 6 (remove table if not necessary)

Country	text here
Title of qualification	text here
EQF level (if appropriate)	text here
NQF level (if appropriate)	text here
Unit(s) of learning outcomes for the mobility phases (refer to enclosure in the annex, if applicable)	text here
Enclosures in annex - please tick as appropriate	☐ Europass Certificate Supplement ☐ The learning outcomes associated with the qualification ☐ Description of the unit(s) of learning outcomes for the mobility ☐ Other: please specify here

5. Assessment, documentation, validation and recognition

By signing this Memorandum of Understanding we confirm that we have discussed the procedures for assessment, documentation, validation and recognition and agree on how it is done.

6. Validity of this Memorandum of Understanding

This Memorandum of Understanding is valid until: text here

7. Evaluation and review process

The work of the partnership will be evaluated and reviewed by: dd/mm/yyyy, person(s)/organisation(s)

8. Signatures

Organisation / country	Organisation / country
Name, role	Name, role
Place, date	Place, date

Organisation / country (remove if not necessary)	Organisation / country (remove if not necessary)
Name, role	Name, role
Place, date	Place, date

Organisation / country (remove if not necessary)	Organisation / country (remove if not necessary)
Name, role	Name, role
Place, date	Place, date

add more tables if necessary

9. Additional information

text here

10. Annexes

text here

Learning Agreement

11. Information about the participants

Contact details of the home organisation

Name of organisation	
Address	
Telephone/fax	
E-mail	
Website	
Contact person	
Telephone/fax	
E-mail	

Contact details of the host organisation

Name of organisation	
Address	
Telephone/fax	
E-mail	
Website	
Contact person	

Tutor/mentor	
Telephone/fax	
E-mail	

Contact details of the learner	
Name	
Address	
Telephone/fax	
E-mail	
Date of birth	(dd/mm/yyyy)
Please tick	☐ Male ☐ Female

Contact details of parents or legal guardian of the learner, if applicable	
Name	
Address	
Telephone	
E-mail	

If an intermediary organisation is involved, please provide contact details	
Name of organisation	
Address	
Telephone/fax	
E-mail	
Website	
Contact person	

12. Duration of the learning period abroad

Start date of the training abroad	(dd/mm/yyyy)
End date of the training abroad	(dd/mm/yyyy)
Length of time abroad	(number of weeks)

13. The qualification being taken by the learner - including information on the learner's progress (knowledge, skills and competence already acquired)

Title of the qualification being taken by the learner (please also provide the title in the language of the partnership, if appropriate)	
EQF level (if appropriate)	
NQF level (if appropriate)	
Information on the learner's progress in relation to the learning pathway (Information to indicate acquired knowledge, skills, competence could be included in an annex)	
Enclosures in annex - please tick as appropriate	☐ Europass Certificate Supplement ☐ Europass CV ☐ Europass Mobility ☐ Europass Language Passport ☐ European Skills Passport ☐ (Unit[s] of) learning outcomes already acquired by the learner ☐ Other: please specify

14. Description of the learning outcomes to be achieved during mobility

Title of unit(s)/groups of learning outcomes/parts of units to be acquired	
Number of ECVET points to be acquired while abroad	Please specify (if appropriate)
Learning outcomes to be achieved	
Description of the learning activities (e.g. information on location(s) of learning, tasks to be completed and/or courses to be attended)	
Enclosures in annex - please tick as appropriate	☐ Description of unit(s)/groups of learning outcomes which are the focus of the mobility ☐ Description of the learning activities ☐ Individual's development plan when abroad ☐ Other: please specify

15. Assessment and documentation

Person(s) responsible for assessing the learner's performance	Name:
	Organisation, role:
Assessment of learning outcomes	Date of assessment: dd/mm/yyyy
	Method: Please specify
How and when will the assessment be recorded?	
Please include	☐ Detailed information about the assessment procedure (e.g. methods, criteria, assessment grid)
	☐ Template for documenting the acquired learning outcomes (such as the learner's transcript of record or Europass Mobility)
	☐ Individual's development plan when abroad
	☐ Other: Please specify

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PENTRU
CALIFICĂRI

MACHINA

16. Validation and recognition

Person (s) responsible for validating the learning outcomes achieved abroad	Name: Please insert
	Organisation, role: Please specify
How will the validation process be carried out?	Please specify
Recording of validated achievements	Date: dd/mm/yyyy
	Method: Please specify
Person(s) responsible for recognising the learning outcomes achieved abroad	Name: Please insert
	Organisation, role: Please specify
How will the recognition be conducted?	Please specify

17. Signatures

Home organisation/country	Host organisation/country	Learner
Name, role	Name, role	Name
Place, date	Place, date	Place, date

If applicable: Intermediary organisation	If applicable: Parent or legal guardian
Name, role	Name, role
Place, date	Place, date

9 REFERENCES

- COUNCIL RECOMMENDATION of 20 December 2012 on the validation of non-formal and informal learning

- COUNCILCOUNCIL RECOMMENDATION of 22 May 2017 on the European Qualifications Framework for lifelong learning

- EQAVET - Validation of learning outcomes Glossary, https://www.eqavet.eu/eu-quality-assurance/glossary/validation-of-learning-outcomes

- CEDEFOP – European guidelines for non-formal and informal learning – 2015

- Using ECVET for Geographical Mobility (2012) - PART II OF THE ECVET USERS' GUIDE

- COUNCIL RECOMMENDATION of 24 November 2020 on vocational education and training (VET) for sustainable competitiveness, social fairness and resilience