Open Virtual Mobility
Open Credentials for Virtual Mobility Skills
- Final draft -

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Executive summary

This paper is a public document produced as part of Outcome O5 "Open Credentials and Gamification", O5-A1 "Conceptual and Visual Design of Open Credentials " in the Open Virtual Mobility Erasmus+ strategic partnership (2012-2020) and describes the process, methodology and results of designing open credentials for virtual mobility skills in the Open Virtual Mobility project.

This publication summarises the results from the first three milestones in O5-A1:
Milestone 1: O5-A1.1: Definition of the design process and tools (February 2018)
Milestone 2: O5-A1.2: Design workshops with VM experts (May 2018)

Milestone 3: O5-A1.3: Set of open credentials to recognise VM skills (September 2018)

The set of open credentials described in this paper is used for implementation and user testing in the Open Virtual Mobility Learning Hub in milestone O5-A2.4: Implementation in the VM Learning Hub and User-Testing (January 2019): https://hub.openvirtualmobility.eu

What are the objectives of this paper?

This paper intends to present the current outcomes of joint work on open digital credentials and to stimulate discussions around the design of OpenVM credentials which will be used to recognise open / virtual mobility skills in the Open Virtual Mobility Learning Hub in January 2019: https://hub.openvirtualmobility.eu

This publications also serves as a documentation of results in Outcome O5 "Open Credentials and Gamification", O5-A1 "Conceptual and Visual Design of Open Credentials " for the reporting period from 01 September 2017 until 31 December 2018 to accompany the interim report submitted by the Open Virtual Mobility partnership to the Erasmus+ National Agency DAAD.

Who is this paper for?

This paper addresses educators, students, international officers and higher education leaders as well as a wider academic audience interested in open digital credentials in context of international mobility in higher education in Europe and beyond. This paper also addresses the reviewers of the interim report for the Open Virtual Mobility project assigned by the National Agency DAAD.

What topics are addressed in this paper?

This paper addresses the following key three topics related to the design of open credentials:
1. Design processes, methods and tools used in the Open Virtual Mobility project
2. Design considerations linking open credentials to VM skills defined in Output 1
3. Design of a set of OpenVM credentials to be implemented in the Learning Hub

Contributors

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Ilona Buchem is Professor for Media and Communication at Beuth University of Applied Sciences Berlin, Faculty I Economics and Social Sciences. She is the coordinator of the Open Virtual Mobility Erasmus+ strategic partnership. Ilona Buchem has led a number of projects dedicated to Open Education and international exchanges in higher education, including Open Badge Network (Erasmus+, Strategic Partnership, KA2 2014-1-DE01-KA200-000675), BeuthBonus and CreditPoints (Qualification Programs for Migrant Academics, German Federal Program "Integration through Qualification") and Digital Future (Digital Strategies for Higher Education, Stifterverband - German Association of Foundations for Science). Her current research focuses on fostering diversity through

educational technology and new media, and closing the digital divide. Ilona Buchem has an extensive experience in designing and fostering national and international virtual mobility actions in higher education including: Seminar 2.0, iCollaborate, Future Social Learning Networks projects.

Dr. Chiara Carlino
Chiara Carlino works at CINECA, the main italian inter-university consortium, as consultant and project manager in Cineca's Business Unit dedicated to Public Administration and Industry. Chiara Carlino holds a Master Degree in Philosophy from the University of Bologna and a second level Master Degree in Web Technologies. Starting with semantic web, she the developed competencies in digital communication, web analysis, user interface and experience design, functional requirements analysis for software applications and the communication of IT projects, products and activities. She works with Open Badges since Bestr startup in 2015, supporting public administration and companies in identifying which improvements the technology could add to their processes. She has participated in the organization of conferences (ePic 2016 and 2017), presented at numerous events and is contact person in Cineca for EU funded projects concerning Open Badges.

Acknowledgements

1. Aims and scope

Aims: This publication aims at presenting the design methodology, tools and results of the design process of open credentials for virtual mobility skills in the Open Virtual Mobility project.

Scope: This publication summarises the results from the first three milestones in O5-A1, i. e.:

1. Milestone 1: O5-A1.1: Definition of the design process and tools (February 2018)
2. Milestone 2: O5-A1.2: Design workshops with VM experts (May 2018)
3. Milestone 3: O5-A1.3: Set of open credentials to recognise VM skills (September 2018)

The set of open credentials described in this paper is used for implementation and user testing in the Open Virtual Mobility Learning Hub in milestone O5-A2.4: Implementation in the VM Learning Hub and User-Testing (January 2019): https://hub.openvirtualmobility.eu

2. Background and rationale (State of the Art)

The current state of the art as a starting point for this publication was summarised in the joint research paper titled "Designing a Collaborative Learning Hub for Virtual Mobility Skills. Insights from the European Project Open Virtual Mobility" presented at the Human Computer-Interaction International Conference, HCII 2018[1] and published by Springer in the conference proceedings[2]. https://docs.google.com/document/d/19JPAeebIAlxzGNdkksw3KG5Rd3sxmz-HoYKdg-89-S8/edit

Digital credentials including Open Badges and Blockcerts are emerging standards to digitally valorize learning outcomes from diverse contexts (including formal, non-formal and informal) and to communicate skills and achievements by providing visual representations of skills with embedded metadata data including evidence of learning that can be easily shared across the web and some degree of verifiability.

The role of open credentials in the Open Virtual Mobility project was defined as follows:

"Open Credentials will be used as a component of the VM Learning Hub to recognise virtual mobility skills. Open Credentials encompass various tools and approaches, including Open Badges and Blockcerts" (Buchem at al., 2018, p. 360).

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[1] http://2018.hci.international
[2] https://link.springer.com/chapter/10.1007/978-3-319-91743-6_27

2.1 Open Badges for the recognition of virtual mobility skills

The Open Badge standard was initiated by the Mozilla Foundation in 2011 and has been adopted worldwide by individuals and organisations including higher education institutions to recognise, visualise and communicate skills and competencies, which often remain unrecognised and/or are not made transparent by formal/traditional degrees and certificates. Open Badges, as a type of a more broad category of Digital Badges[3], are information-rich digital records of skills, competencies, learning outcomes, achievements and provide a flexible way to issue a proof for a skill or competency and to enrich this proof with criteria, evidences and endorsements required to earn a given badge (Buchem et al., 2018). Open badges have been considered as an important (but not the only one) component of the emerging digital credentials ecosystem. Since 2017 IMS global has been responsible for managing and advancing the Open Badge specification[4], leading to the publication of Open Badges 2.0 specification[5].

Open Badges have a form of a Portable Network Graphics (PNG) with embedded metadata allowing the verification of each issued Open Badge. The Open Badges specification describes a method for packaging information about accomplishments, embedding it into portable image files as open badges[6]. This standard method for packaging information included in Open Badges allows to validate each open badge as a metadata package. A number of badge data validation tools, including the IMS Global Open Badges 2.0 Validator[7], can be used to ensures that the data making up an Open Badge are appropriately published and linked, and that each particular instance of a badge conforms to the requirements of the Open Badge specification.

The progress from Open Badges 1.0 to Open Badges 2.0 does not bring substantial modifications to the core function of conveying verifiable information about a skill or achievement of a learner as expressed by the Badge issuer: backwards compatibility is guaranteed while adding new potential through new features. One of the most discussed Open Badge 2.0 feature is that of Endorsement[8], which allows a "Verifiable claim" to be expressed about any entity - including Badge classes, Badge awards, Badge issuers.

The OpenVM project applies Open Badges by using the Bestr[9] digital badging platform provided by the project partner Cineca[10] - a not-for-profit Consortium, made up of 67 Italian universities*, 9

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[3] Digital badges is a broader concept and also includes non-open implementation of badges, e. g. available only inside one system.
[4] http://www.imsglobal.org/activity/digital-badges
[5] https://www.imsglobal.org/sites/default/files/Badges/OBv2p0Final/index.html
[6] https://www.imsglobal.org/sites/default/files/Badges/OBv2p0Final/index.html
[7] https://openbadgesvalidator.imsglobal.org
[8] https://www.imsglobal.org/sites/default/files/Badges/OBv2p0Final/index.html#Endorsement
[9] https://bestr.it
[10] https://www.cineca.it/en

Italian Research Institutions, and the Italian Ministry of Education. At the moment of writing, Bestr does not support Open Badges 2.0 yet, however it offers an early implementation of the Endorsement functionality, limited to Badge classes, which will allow to use the concept of endorsement in the OpenVM project.

While Open Badges have been used to provide a quickly verifiable evidence of formal learning and to accompany formal degrees (e. g. University of Milan Bicocca[11], Beuth University of Applied Sciences[12]), much enthusiasm has been drawn to the field of certifying non-formal and informal learning (e. g. CreditPoints[13], Oncampus[14]) , especially 21st century, employability and soft skills, as an important method for the recognition of learning in ever changing, diverse contexts.

Having proved its value in recognition of informal and non-formal learning, Open Badges can also contribute to formal learning with diverse learning paths being recognised by a school or university based on the data included in Open Badges as shown by the experience of automatic recognition of Open Badges by the Italian Student Information System (Buchem et al., 2018).

2.2 Open Assessment though xAPIs and Learning Record Store

The key to the recognition of skills developed in different contexts is the ability to gather learning information or learning experiences from a variety of sources where learning and assessment can happen. Instead of designing – with a top-down approach typical of formal learning – a single main learning path where learning experiences should happen, multiple and diverse learning experiences can be captured and referenced in the light of relevant competencies. Technically, this can be achieved through the use of of the Experience API, more commonly called Experience API (xAPI)[15].

The xAPI is an open specification designed to allow the interoperable exchange of learning and performance activity data between various systems and applications (Johnson, 2017). The xAPI standard aims at opening up the way learning experiences can be captured, stored and used. With xAPI any system can express a learning experience through a statement describing how a learner (the subject) has performed an action (the verb, e. g. answered), with reference to an object (e. g. questionnaire). Statements are captured in xAPI format and stored in a Learning Record Store (LRS) receiving, storing and returning data about learning experiences, achievements and performance[16]. A Learning Record Store acts as a specialized database for xAPI data generated by different systems (e. g. LMS, apps, blogs, forums), called activity providers.

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[11] https://www.unimib.it/node/9485

[12] https://beuthbadges.wordpress.com

[13] https://www.slideshare.net/ibuchem/social-media-skills-for-professional-online-reputation-of-migrant-jobseekers

[14] https://www.oncampus.de/plattform

[15] https://xapi.com/overview

[16] https://xapi.com/learning-record-store

Bestr - the Open Badge platform used in the OpenVM project - has its own Learning Record Store and is capable of collecting xAPI statements from any platform integrated with it (Bertazzo et al., 2016). Criteria for issuing Open Badges through xAPI in Bestr are defined according to verbs and objects of learning statements which the learner must accomplish in order to gain a specific badge. When the platform identifies that a set of statements for a given subject (the learner) is matching the criteria required for issuing/earning an Open Badge, this badge is issued to the learner (earner). Having obtained an Open Badge is a new learning statement (a new learning achievement), which can be tracked by the Learning Record Store and used as a starting point for issuing a new Open Badge.

Leveraging this system based on open standards, the OpenVM Learning Hub will be able not only to express its own learning statements connected to learning activities provided by the OpenVM project, such as OpenVM MOOC and OER, but also to capture learning statements from any other compliant and authorised platform towards the LRS, and use any set of such information to activate the automatic issuing of Open Badges. This will allow to expand the reach of the project if interested partners are found, and to convey the message of skills being recognized independently from where they are have been developed.

2.3 Blockcerts for encrypted certification

The OpenVM project has also considered the opportunity to introduce, besides Open Badges, a blockchain-based technology for digital certifications of skills. Blockchain as an emerging technology enhancing self-sovereignty, trust, transparency, immutability, disintermediation and collaboration has been intensively discussed in 2017-2018, also in relation to its uses in education. The key publication in this context has been the European Commission's JRC Science for Policy Report *Blockchain in education* (Grech & Camilleri, 2017). This report explores the feasibility, challenges, benefits and risks of blockchain technologies applied to formal and non-formal education credentials and describes a selection of case studies for pilot implementations of blockchain in education, for example MIT USA, Open University UK, the University of Nicosia and nation-wide applications in Malta. The early pilots described in the JRC report show that blockchain has a potential to accelerate the end of a paper-based system for certificates and the process of automatic verification of the validity of certificates against the blockchain data (Grech & Camilleri, 2017). Applications of blockchain in education may specifically disrupt student information systems, facilitation of payments within institutions and accreditation of organisations by quality assurance bodies (Grech & Camilleri, 2017). The JRC report recommends that the EU in collaboration with Member States creates and promotes open educational records to promote recipient ownership, vendor independence and decentralised verification.

One of the blockchain technologies used to recognise learning are Blockcerts[17] developed by MIT and the Learning Machine. Blockcerts is an open standard for educational certificates and in the words of EC JRC report *Blockchain in education* (Grech & Camilleri, 2017) can be defined as follows:

"The cornerstone of the Blockcerts open standard is the belief that people should be able to possess and prove ownership of their important digital records. [..] Within this context, the Blockchain is considered to be a technology that allows individuals to own their official records and share them with any third-party for instant verification, all the while precluding any attempt to tamper with or edit the records."

The Blockcerts open standard builds on the Open Badges 2.0 specification[18] focussing on recipient control of the certificate and enabling the certificate notarization and verification on a blockchain, which can be based on either Bitcoin or Ethereum technology.
Blockcerts design a coordinated process between issuer, recipient and blockchain which preserves and protects the credential ownership (self-sovereign or self-ownership). The recipient is the only one who can claim her/his title or skill because the credentials are issued with her/his public key, which is a blockchain address.

The Blockcerts suite, besides the specification according to which certificates must be written, provides some code modules that can be used to build applications taking care of the various steps that build up the whole process: the "cert-issuer" module adds to the Open Badge 2.0 json additional fields and the signature showing the Merkle Proof[19]; the "cert-wallet" is a mobile application enabling a recipient to create her/his credentials (private key) and completing the issuing process[20]; the "cert-verifier" module checks validity of the certificate by comparing its hash with the one notarized on the Blockchain and against the revocation list.

These core modules can be used to build a project's own application, or a ready-to-use commercial one can be chosen, such as that provided by Learning Machine[21] which enables to issue, track and verify Blockchain-based records (Grech & Camilleri, 2017). These tools include the federated issuing system including a mobile app, a visual template designer and analytics, branded verification pages and an API. A ready-to-use solution also usually embeds a specific choice as to which Blockchain is used for writing, i.e. Bitcoin or Ethereum based, public or permissioned.

The Bestr platform provided by project partner Cineca will implement a Blockcert feature in 2019, allowing the project to experiment with this new technology, e. g. to encrypt higher level badges.

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[17] https://www.blockcerts.org
[18] https://www.blockcerts.org/guide/standard.html
[19] https://w3c-dvcg.github.io/lds-merkleproof2017/
[20] https://github.com/IMSGlobal/cert-schema/blob/master/docs/recipientProfileExtension_schema.md
[21] https://www.learningmachine.com

3. Design process: methodology, tools and results

The OpenVM project has explored how Open Badges and Blockcerts can be applied to recognise and communicate OpenVM skills of educators, students and other higher education stakeholders (e. g. international officers, program leaders) in the process based on Design Thinking methodology. This section describes the design process, methods, tools and results of each design step.

3.1 Design Thinking Methodology

The overall methodology applied in our O5-A1 to design open credentials as instruments to recognise OpenVM skills follows the Design Thinking[22] approach as a human-centered design process which is composed of six phases following the model proposed by the d-school of design at Stanford University (d-school, 2010). The d-school model traditionally proposes five phases or modes of design. This model has been extended by adding a phase of design pattern development which comprises the fifth phase before the testing mode. The Design Thinking methodology applied in the OpenVM project is summarised below:

1. **Empathise**: Empathy is the centerpiece of the design thinking process. To empathize means to understand users, including their values, problems and needs, within the context of a design challenge. Methods uses in this phase include observations and engagement with users. In the first step from February to May 2018 a number of observations and interactions with potential users of open credentials with focus on higher education teachers and students took place both on-site at OpenVM project partner universities (e. g. one-on-one conversations, meetings and workshops with colleagues, students, international officers) as well as on-line, e. g. following / observing discussions around the design of Erasmus+ Virtual Exchange Open Badges[23]. Based on observations and interactions conclusions have been drawn for the next phase of the Designing Thinking process - the "define" phase/mode.

2. **Define**: Define phase/mode focuses on discovering connections and patterns from the multitude of insights gained in the first phase and thus bringing clarity to the design process. The goal is to define a meaningful and actionable problem statement which will be guiding the design process. A key methods used in this phase is synthesizing findings into a focused point-of-view (POV) which defines the challenge to be addressed in the design process based on the understanding of users and contexts. The goal of this design step in the O5-A2 was to design a well-scoped challenge and to clarify the focus of the design. In the OpenVM project the point-of-view (POV) has been defined in the form of a following design challenge: *"Design a set of Open Credentials which will enable to match user needs with what is*

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[22] http://www.designkit.org/methods
[23] https://europa.eu/youth/erasmusvirtual/erasmus-virtual-exchange-badges_mt

technologically feasible and to promote OpenVM skills in higher education bringing tangible value to organisations, educators and students".

3. **Ideate**: Ideate phase/mode focuses on idea generation. The key principle is not to strive to develop the "right" idea at the beginning but to develop a wide range of ideas to choose from. The results of this phase provide the material for building prototypes in the next step. The goal is to transition from identifying problems to creating solutions based on understanding user needs. It is important to notice that the final idea/solution is not selected in this phase but is discovered in later steps, through user testing and feedback. In this phase/mode a number of methods can be used to find a wide set of ideas, e. g. workshops, brainstorming and prototyping sessions to harness collective perspectives on the diversity of innovation options. In the OpenVM project three key methods were used in the ideation phase: (1) on-site workshops with Open Badges experts/stakeholders which included brainstorming and prototyping, (2) internal consultations on xAPIs and LRS, and (3) external online-consultations with Blockchain/Blockcerts experts. These three methods and results of this stage are described in more detail in section 3.2 below.

4. **Prototype**: The Prototype phase/mode is focused on the iterative generation of artifacts intended to solve the design challenge. It is advised to start with quick low-resolution prototypes and use them to elicit feedback from users and colleagues. Then the prototypes get refined, e. g. by adding new features or details. According to the Design Thinking methodology anything than enables interaction can be used as a prototype, e. g. post-it notes or a storyboard. In the OpenVM project we created and used paper-based prototypes to elicit feedback and progress. Paper-based prototypes were created using a number of templates, especially: (a) Bestr template for creating a badge in Bestr, (b) Badging Toolkit[24] and (c) Badge Design Canvas.[25] First prototypes were built during the expert/stakeholder workshop im May 2018 (early-stage, low-fidelity prototypes) and refined as follow-up to the workshop from June until July 2018 (later-stage, high-fidelity prototypes). When designing refined prototypes at the later stage, a number of important design considerations had to be taken into account, especially aligning badge designs with the OpenVM skill set develop in Output 1 "Framework and Guidelines" of the project.

5. **Pattern development:** In this phase, which was added to the original d-school model of Design Thinking, the prototyping iterations / ideas were abstracted into design patterns, which serve as templates for the design of a set of eight prototypes of open credentials in the OpenVM project, each prototype related to a particular OpenVM skill identified in Output 1 "Framework and Guidelines" of the project. This step has been important for quality assurance of open credentials as the developed design pattern allows to create single prototypes following a standard pattern. The generative design pattern for open credentials in the OpenVM project have been described in the DeLFI 2018 research paper by Buchem

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[24] https://canvas.instructure.com/courses/826612/files/26095979?module_item_id=5382496
[25] https://drive.google.com/file/d/0By9JfART0xQ8dVdXT3VxY2NnRFE/view

(2018) titled "Design patterns for digital competency credentials based on open badges in the context of virtual mobility" and are described in more detail in section 3.3 below.

6. **Testing**: The test phase/mode focuses on gathering feedback about created prototypes. Testing is seen as an opportunity to understand the users even better that it was possible in the initial empathy mode. Design Thinking recommends to approach testing with the "Why?" question in mind, i. e. focusing on what can be learned about the users, the problem and about the potential solution. To test the created prototypes for all eight OpenVM skill types (as described in section 5 below), a set of realistic scenarios will be created and embedded in the OpenVM Learning Hub using Bestr as the bading system to capture real feedback from users. Potential users, i. e. representatives of the key target groups including educators, students, international officers, will test open credentials embedded in an authentic scenario. The aim is to allow users to test a learning experience rather than a prototype without a context. Users will be also asked to compare the open credential scenarios created for the test, which will provide a basis for comparison to reveal user needs and expectations. The testing of the prototypes in scheduled for the end of 2018. The results will be described in the 4th milestone O5-A1.4: Implementation in the VM Learning Hub and User-Testing (January 2019).

Below we described selected phases and results of the Design Thinking process focused on open credentialing of VM Skills in the OpenVM project.

3.2 Expert workshops and consultations

In this section we describe the expert/stakeholder workshop and consultations as part of the Design Thinking process related to phases/modes (3) Ideate and (4) Prototype as described in section 3.1 above.

3.2.1 Expert workshop on Open Badges

The design workshops dedicated to open credentials are milestone 2 in the output O5-A1.
The following two workshops took place in May 2018:

1. Open Credentials Workshop titled "Design Workshop with VM experts" on 15 May 2018 at Open University NL, Welten Institute in Harleen, NL with 10 on-site participants and one online participant from partner organisations Open University NL, EADTU, KU Leuven, Cineca, Beuth University and one external expert from EUMIND.
2. Open Credentials Workshop titled "Decentralised Models for Collaboration. Supporting Open Education through Technology" on 18 May 2018 at the 3CML Blockchain and Credentials Conference in Malta[26] with 23 participants from higher education organisations in Europe including educators, researchers and teacher training units.

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[26] https://3clevents.com/

Workshop 1 on 15 May 2018, 09.30 - 14:30, at Open University NL in Harleen was conducted as follows:

- Part 1: Introduction of participants, OpenVM project and Open Badges incl. Q&A
- Part 2: Understanding recognition of VM skills - an interactive part with two sub-parts:
  - What are the current problems in recognition of VM skills? Goal: Understanding current problems recognition of skills (a) acquired through VM, and/or (b) necessary for VM. Method: Brainstorming and post-its
  - What are the needs of target groups? Goal: Understanding needs, expectations and preferences of users related to Open Badges. Define what matters most to users in relation to recognition of skills with Open Badges. Method: Interactive board.
- Part 3: Prototyping with Badge Design Canvas and OpenVM Design Template - interactive part. Goal: Design challenge: Design a set of 4 badge categories for the 4 OpenVM skills.
- Part 4: Reflection and design recommendations
- Part 5: Planning next steps incl. user testing

Workshop 2 on 18 May 2018, 15:00 - 16:30, at the 3CML Conference in Malta was conducted as follows:

- Part 1: Introduction to the OpenVM project and Open Credentials including results from workshop 1
- Part 2: Discussion about current designs of open credentials and recommendations of experts related to OpenVM skill assessment criteria and methods for the initial set of the four OpenVM credentials.

A number of design tools such as the Badge Design Canvas and the OpenVM Design Template (see attachments and figure 1 below) were used to support the design process.

Figure 1: Materials used at the design workshops in May 2018

The Badge Design Canvas[27] is a free design tool developed by DigitalMe UK, applied and updated in the Erasmus+ Open Badge Network[28]. Badge Design Canvas was used in workshop 1 and allowed to take the participants of design workshops through a step-by-step process by considering key design aspects and answering key design questions specifically related to Open Badges.

The key design questions triggered by the Badge Design Canvas are:

- Who will receive the badge?
- Who will issue the badge?
- Which individuals or organisations will recognise the badge?
- What skills does the badge represent?
- What behaviour does the badge encourage?
- What would motivate people to engage with the badge?
- Who could endorse the learning content of your badge?
- Where will earners display our badge?
- Will your badge be issued as part of a course, project or other learning activity?
- How will someone evidence their learning?
- What other badges exist in your ecosystem? Are there different levels?

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[27] https://drive.google.com/file/d/0By9JfART0xQ8dVdXT3VxY2NnRFE/view
[28] http://www.openbadgenetwork.com/

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- What resources are needed for your badge to work, e. g. technology, expertise, money?

The Badge Design Canvas also includes a design template for visual design of open badges, which allowed participants of the first design workshop to:

- design the **badge image** including icons and images to convey the meaning in straightforward way,
- work out the **name and badge description** in such a way that the badge conveys the purpose and the value of the badge to the learner, and
- define **tasks** which are necessary to be completed by the learner in order to earn the badge including **evidence required and supporting media** (e. g. results of the evaluation of an e-portfolio with the link to the e-portfolio with reference videos).

The OpenVM Design Template was specifically designed for the purpose of the OpenVM project using the badge image design template by Bestr and key design elements from the Badge Design Canvas. Version 1 of the OpenVM Visual Design Template (see attachment) was used in the first design workshops and was later modified to align the design pattern with the final version of the OpenVM skill set developed in O1. The main change for modification was an extension of the OpenVM skill set from originally four skill types to the final set of eight OpenVM skill types. The OpenVM Visual Design Template allows for a quick brainstorming and idea-generation in small groups with the focus on the design of key elements of open credentials, i. e. (a) badge name, (b) skills referenced in the badge, (c) skill level, (d) assessment criteria, (e) task required to earn a badge, (f) evidence required to earn a badge, (g) name of the issuer, and (h) name of the endorser.

The results of both design workshops are described below.

A. Results of the first design workshop at OU NL, Harleen:
(1) A list of current problems related to the recognition of virtual mobility skills (cf. figure 2).
(2) A list of user needs structured by stakeholder groups identified in the OpenVM proposal (cf. figure 3).
(3) Prototypes developed using Badge Design Canvas and OpenVM Design Template (cf. figure 4).

Figure 2: Problems in recognition of virtual mobility skills identified at the first design workshops
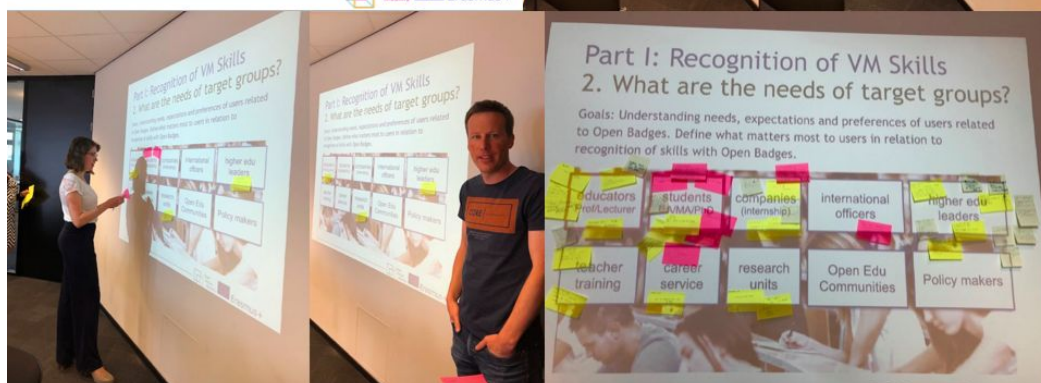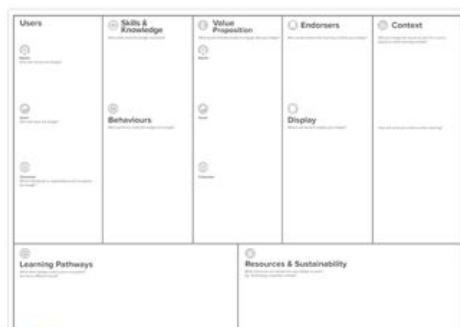

Figure 3: The needs of the target groups worked out at the first design workshops in May 2018

Figure 4: Prototypes developed using Badge Design Canvas and OpenVM Design Template

The prototypes developed at the first workshop were presented at the second workshop in Malta (cf. figure 5). The prototypes of OpenVM credentials were designed in alignment of the preliminary results of the Group Concept Mapping research conducted as part of the conceptual framework development in output 1 (O1). The preliminary research results from O1 comprised four OpenVM skill types, i. e. (1) open mindset, (2) digital skills, (c) intercultural skills, and (d) self-regulated learning. This initial skill set was later extended based on further research and analysis in O1 (see section 4 below).

B. Results of the second design workshop at 3CLT, Malta:
(1) Recommendations for skill descriptions in OpenVM badges related to existing competency frameworks.
(2) Recommendations for the measurement of openness as one of the key OpenVM quality (cf. figure 3).

The results of from the first design workshop were presented at the second design workshop which focused on further design iterations and elicited recommendations from participating experts about OpenVM skill assessment criteria and methods for the initial set of the four OpenVM credentials. While it was briefly stated and recommended to use existing competency frameworks and models to elicit assessment criteria and methods for the three skill types: digital skills (e. g. The EC Digital Competence Framework[29]), intercultural skills (e. g. the UNESCO model[30]), and self-regulated learning (e. g. Self-Regulation Questionnaire

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[29] https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework
[30] http://unesdoc.unesco.org/images/0021/002197/219768e.pdf

[31]), much of discussion revolved around meaning the first skill set, i. e. open mindset / openness. The experts recommended using available items and survey, such as Multicultural Personality Questionnaire[32] and the publication "Measuring Open-Mindedness"[33] by the Tony Blair Institute for Global Change (cf. Figure 5).

The recommendations from experts from the second workshop were used for internal discussions inside the partnership about which existing competency frameworks and scales / questionnaires can be used in the OpenVM project to assess the key OpenVM competency areas referenced in open credentials and how to express badge descriptions for each competency type including skills description, skill level, evidence and criteria necessary to issue each open credential (all of which are part of the open badge metadata standard embedded in each Open Badge issued from the Bestr system).

Figure 5: Discussion focus and recommendations from the second design workshop

3.2.3 Expert consultations on Blockcerts

The OpenVM project has explored the benefits and challenges of a permanent and encrypted recording of achievements such as those that will happen through the OpenVM Learning Hub, by interviewing three experts with different and comprehensive experiences with Blockcert technology in April/May 2018:
- Natalie Smolensky, Business Developer for Learning Machine
- Alex Grech, Consultant for the Government of Malta
- Phillip Schmidt, contributor to the design of Blockcert standard at MIT

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[31] http://www.researchcollaboration.org/uploads/Self-RegulationQuestionnaireInfo.pdf

[32] https://www.researchgate.net/publication/230831358_Multicultural_Personality_Questionnaire_Development_of_a_Short_Form

[33] https://institute.global/sites/default/files/inline-files/Measuring%20Open-mindedness_29.06.17.pdf

The interviews were performed separately through skype in 90 minutes time for each expert, following a list of 10 questions[34] aiming at covering all aspects relevant to the project: Use Cases, Technology, Benefits and Costs. The interview questions to experts about the use of Blockcerts in OpenVM were divided into three parts: (A) Use Cases, (B) Technology, and (C) Benefits and Costs.

A. Use Cases

1. What is the use case best solved by Blockcerts?
2. Are Blockcerts useful for high level certificates or are there applications for micro credentials as well?
3. What would be suitable use cases for the application of Blockcerts to recognise virtual mobility skills in Europe, e. g. intercultural skills, digital skills (of students and educators)?
4. In your experience, is immutability always good from an educational point of view, or does it depend on the context? if so, how?
5. What about Blockcerts and privacy? Is a credential recorded via Blockcerts always accessible by anybody?

B. Technology

6. What technical platforms/systems would be needed to implement Blockcerts?
7. Does Blockcert store the whole Badge or does it only help in its verification?
8. Is it technically supported to store an Open Badge via Blockcert decentrally, but still allow recipients to import it into their Badge Backpack? In other words: Does Blockcert preserve the Open Badge or does it convert it into a blockcert with no way back?

C. Benefits and costs

9. Are decentralized storage and immutability the only two core benefits of blockcerts compared to a self-hosted verification API by Open Badge Standard? Is it practicable to use both in parallel?
10. What are the costs of using Blockcerts?

The results from the three interviews are summarised below.

Use Cases: A substantial agreement has been noted about Blockcerts and more broadly speaking Blockchain notarization being particularly relevant when credentials heavily benefit from being always accessible and rapidly verifiable independently from the issuing institution (i. e. even if the issuing institution ceases to exist); this usually means high level credentials capable of providing access to high level opportunities (i. e. practicing a profession, accessing an institution). Although it is possible to use Blockcerts for micro-credentials[35], micro-credentials would not especially benefit from the specific features enabled by Blockcerts; on the other hand it would be possible and meaningful to attach stackable microcredentials as evidence to a final full credential recorded on Blockchain. Relevant use cases covered include Universities degrees, professional licences that need to be verifiable internationally without the need to call on the original country institutions, credit recognition among universities: all instances where empowering the learner with all necessary tools to prove his/her learning and capabilities and allowing the issued certificate

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[34] https://drive.google.com/open?id=1OU4eRa1yeuJcla4NciF8U3b7RTRsCkF7

[35] Micro-credentials are granular certifications of a specific skill and are "smaller" in scope that traditional certificates. Open Badges are often referred to as a solution for digital micro-credentials.

to be proved without calling on the issuing institution radically solve and simplify current use case issues, such as migrants and refugees being unable to prove their skills relying on traditional certificates.

Verifiability vs. trust: It has been pointed out by one expert that the Blockcert technology allows for a secure verification of authenticity (i.e. the verification that the certificate contents are real and not tampered with; that the certificate has actually been issued by the declared issuer to the declared recipient at the declared date; that it has not been revoked nor has it expired), but does not cover the topic of trust, as the certificate reader will still evaluate the issuing institution trustability based on parameters external to the Blockcert system.

Blockcerts vs. Open Badges: Blockcerts are not to be considered as an alternative to Open Badges, as the Blockcert standard builds on the Open Badges standard and Open Badges can be registered on the Blockchain as Blockcerts in the same way as other certificates or credentials can. It has also been remarked that, while Open Badges are usually adopted to highlight acquired competences also in the eyes of the learner - thus performing a pedagogical role and calling for new pedagogies for learning, development and assessment of competencies and skills - Blockchain certificates or Blockcerts do not add anything to the pedagogical quality. What Blockcerts substantially enable is that the learner completely owns his/her certificates and has complete agency (sovereignty) upon them, being able to prove their authenticity without the need to call in any other institution, whereas Open Badges rely on issuing platforms to provide verification for any badge.

Technology and costs: It is possible to use the open source code provided by Blockcerts.org, including the code modules covering most of the steps required to issue and verify blockcerts, including a Blockcert mobile app. Using open code to create an own blockchain-based certification system would still require additional development effort and human resources (including specialised programming skills) which are not available in the current OpenVM partnership and could not be subcontracted due to Erasmus+ regulations. An alternative would be to buy a ready-to-use solution/service from one of the vendors. However, the costs of a ready solution/service would exceed the planned project budget and would also be not eligible under Erasmus+ financial rules. On top of that, for the system to keep its promises of permanent independent verifiability certificates must be recorded on a blockchain that is either public or a very large permissioned system whose nodes are highly committed, such as a network of institutions covering their own use case (e.g. a network of European universities). If a public blockchain is chosen - be it Bitcoin or Ethereum, both supported by Blockcerts - each time that something is written onto the Blockchain (transaction) the nodes performing the action (miners) must be paid according to costs who are constantly changing and tend to grow. This makes it hard to estimate the exact costs for the use of blockchain-based certification in the OpenVM project - a cost that must be constantly sustained and adds to the implementation cost. For a high level evaluation approximately 1-2$ per transaction can be currently estimated as a realistic calculation, which can be cut by writing certificates in bulk through a merkel tree[36]: this would allow to make not one transaction per certificate, but one transaction per set of (even thousands of) certificates - leading to the contra that a single certificate would not be blockchain-verifiable until its bulk-writing moment has come.

Communication and complexity: In view of the complex nature of the blockchain technology as described above and due to the fact that it has been radically evolving over time, using Blockcerts in the OpenVM

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[36] https://en.wikipedia.org/wiki/Merkle_tree

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project would require a lot of attention directed to the communication of the technology, its use and benefits to target users (educators, students, international officers etc.). The technological complexity of Blockchain / Blockcerts, combined with the new concept of Open Virtual Mobility of the project, could pose excessive demands on the OpenVM target users, possibly leading to confusion and deterioration of learner experience in the OpenVM Learning Hub.

Decisions and takeaways: The subject of the project, Open Virtual Mobility skills, seems to be not ideally suited to benefit of the major advantages provided by Blockcert technologies, as it focuses on micro-credentials and recognising soft skills rather than issuing high-stake credentials such as school certificates and university diplomas. Since one purpose of the project is building awareness about Open Virtual Mobility skills, Open Badges seem adequate to provide learners with evidence that helps them identify, value and share their skills. The flaw of dependency from platforms for verification seem not to pose excessive threats to the current use case in the OpenVM project. Moreover the involvement of Blockcerts would require substantial effort, both in technical development (or in acquisition of a system) and in communication of this complex technology to OpenVM users. It is definitely easier to explain/communicate advantages of one digital credentialing system to users than it would be combining two systems - Open Badges and Blockcerts. In order to make it as easy and accessible as possible for all OpenVM users (including issuers, recipients, readers, endorsers) to develop, assess and recognise their OpenVM skills in the OpenVM Learning Hub, it seems reasonable to the partnership to focus on Open Badges only as a key technology for open credentialing for OpenVM skills and to use the Bestr badging system in an targeted way focusing on issuing open micro-credentials for soft skills. However, since there is a chance - offered by project partner Cineca - to experiment with the Blockcert notarization of Open Badges, this opportunity will be taken, as a field test of the introduction of Blockcerts to higher Education students from different universities. This will allow the project to gather relevant feedback with a relatively small effort. Bestr solution will allow the project to identify some Badges that will also be notarized on Blockchain; the issuing of these Badges will be notarized on the public Ethereum Blockchain up to a maximum number that will be defined.

4. Design considerations: linking open credentials to skills

The design of OpenVM Credentials is closely aligned to the OpenVM Competency Framework developed in Output 1 based on the results of the Group Concept Mapping (GCM) research.

The Open Credentials in the OpenVM project are based on the research results from Output 1 "Conceptual Framework". This output conducted an empirical Group Concept Mapping study (GCM) and identified eight OpenVM skill types, i. e. (1) media and digital skills, (2) intercultural skills, (3) OpenVM knowledge, (4) collaborative learning, (5) networked learning, (6) open mindset, (7) self-regulated learning and (8) autonomy driven learning (cf. Figure 6). The detailed information of each OpenVM skill including its sub-skills was described in Output 1 and the current version of the competency framework published on the project website[37].

![OpenVM Credentials schematic diagram showing eight skill clusters with values: intercultural skills 65, collaborative learning 65, OpenVM knowledge 50, autonomy-driven learning, networked learning 55, media and digital skills 80, self-regulated learning 65, openmindedness 45, with a central value of 25. Legend lists: intercultural skills, collaborative learning, autonomy-driven learning, networked learning, media and digital skills, self-regulated learning, openmindedness, OpenVM knowledge.]

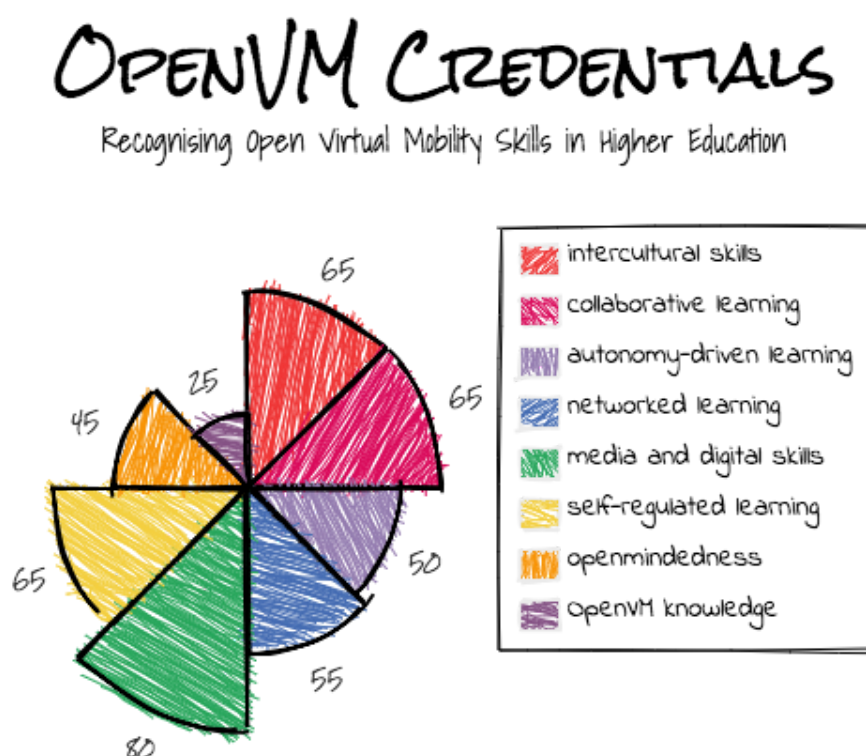Figure 6: Schematic image of the eight OpenVM skill clusters

However, the design of the OpenVM Competency Framework and hence of OpenVM Credentials has not emerged in this mature form straight away but was developed iteratively, i. e. in a cyclic process of prototyping, testing, analyzing, and refining the design. The design iterations are described below.

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[37] https://www.openvirtualmobility.eu/outputs

4.1 From OpenVM Skill Framework to OpenVM Credentials

The OpenVM Skill Framework has been translated to the design of OpenVM Credentials at different stages of the iterative development. The development of OpenVM Credentials has comprised the following iterations:

Phase A "4 Skills": In the first three design iterations, OpenVM Credentials were based on the preliminary results of the Group Concept Mapping research in Output 1 (O1). The preliminary research results from O1 comprised four OpenVM skill types, i. e. (1) open mindset, (2) digital skills, (c) intercultural skills, and (d) self-regulated learning. This initial skill set was later extended based on further research in O1 (cf. Figure 7).

- **Iteration 1:** Developing the concept for the badge image using OpenVM project logo colors to mark different OpenVM skill types, i. e. each of the four logo colors to mark a particular OpenVM skill in the badge image. This idea was translated into the design of the OpenVM badge images using a neutral template in hexagonal shape provided and required by bestr.

- **Iteration 2:** Developing an concept for the badge image description using available fields in the Bestr badge image template, i. e. Heading 1, Heading 2 and Heading 3 with a place for a visual. The requirements of the Bestr template were translated into a general design for OpenVM credentials with the main skill type (Heading 1), the sub-skill of the main skill type (Heading 2) and skill level (Heading 3). The project logo has been chosen to be the key visual for the OpenVM badge image.

- **Iteration 3:** Developing the concept for each of the four OpenVM skill types combining colors, main skills and subskills into single badge images and adding badge descriptions using OpenVM Design Template.

Figure 7: Designs of OpenVM Credentials in the first three iterations

Phase B "8 Skills": The initial OpenVM skill set was extended from four OpenVM skill types (i. e. open mindedness, digital skills, intercultural skills, and self-regulated learning), to altogether eight skill types (i. e. adding collaborative learning, autonomy-driven learning, networked learning and Open Education & Virtual Mobility knowledge). This decision was based on the final results of the Group Concept Mapping in Output 1, which clearly revealed eight separate clusters of OpenVM skills, each comprising several sub-skills. This extension of the preliminary OpenVM skill-set had to be taken into consideration when designing further prototypes of OpenVM credentials.

- **Iteration 4:** In the next iteration the design challenge was to use the four logo colors to create eighth badge image types for OpenVM skills. This design challenge was solved in the following way: Each OpenVM badge image is a combination of two out of four colors of the OpenVM logo. In the second iteration the designs of OpenVM credentials included both placeholders for sub-skills and for levels. Figure 8 shows the design of the eight OpenVM Credential images in this iteration.
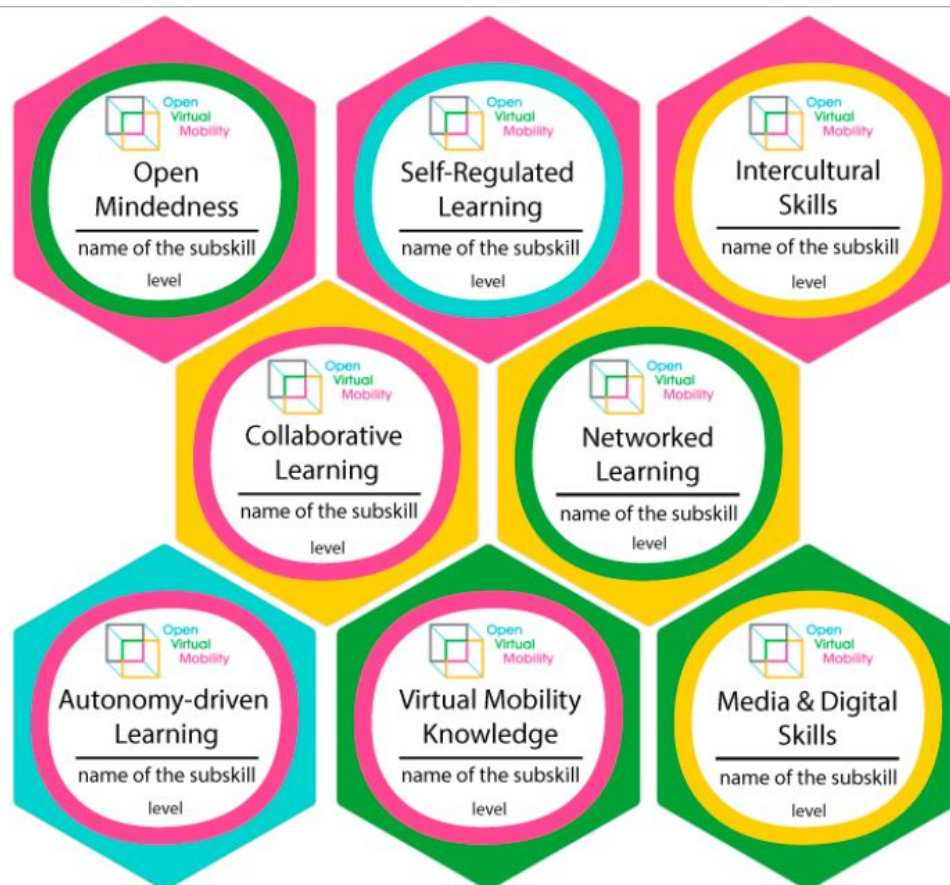
Figure 8: OpenVM Credentials badge image designs with sub-skills and levels

- **Iteration 5:** The following iteration resulted from the detailed planning of the first sub-MOOC in Output 6 dedicated to Media and Digital Skills. Based on the discussions in the partnership and on the alignment in designs of the OpenVM MOOC, E-Assessment and Digital Credentials the new version of the design emerged: OpenVM Credentials will not be divided into credentials for each sub-skills (which would immensely increase the complexity of the badging system), but will recognise

only the main eight OpenVM skills at three levels defined for the OpenVM MOOC, i. a. basic level, intermediate level and advanced level. Figure 9 shows the design of the eight OpenVM Credential images in this iteration based on two selected examples of OpenVM Skills.

Figure 9: OpenVM Credentials badge image designs with three levels

The current OpenVM Credentials designs will be tested in the first pilot sub-MOOC on media and digital skills.

4.2 Links from OpenVM Credentials to Competency Frameworks

A further design consideration has been the references to existing competency frameworks. Specifically, the European Skills Competency and Occupation framework (ESCO)[38] framework has been considered as a valuable reference for OpenVM skills and reflected in the design of the Competency Directory in Output 3. While a great number competency frameworks exist, most frameworks are defined for a certain (narrow) domain and do not provide machine readable formats. The ESCO framework addresses this problem and has developed a semantic, machine-readable vocabulary with more than 8000 competencies and relations between which have been used in Europe for job descriptions (Buchem at al., 2018). Since the current version of ESCO does not cover all OpenVM skills and sub-skills defined in the OpenVM project, using ESCO vocabulary to reference skills in OpenVM credentials has been considered in the partnership as an optional add-on cross-reference, which will be tested at an experimental level (Buchem at al., 2018).

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[38] https://ec.europa.eu/esco/portal/home

To achieve this, the OpenVM Competency Directory developed in Output 3 and initiated in the former Erasmus+ project Open Badge Network[39], will support the automatic crawling and updating of competency framework data and provide unique URLs with a web-based search interface (Buchem at al., 2018). One of the first conceptual steps has been to match OpenVM Skills to the ESCO framework. The following Table gives an example of ESCO mapping for Media and Digital Skills to be tested in the first pilot.

Table 1: Mapping OpenVM Skills to the ESCO framework

OpenVM Skills	Links to ESCO
Digital Competencies	http://data.europa.eu/esco/skill/aeecc330-0be9-419f-bddb-5218de926004
digital communication and collaboration	http://data.europa.eu/esco/skill/574257ea-7b64-4100-b7b6-e27c233fe143
use online tools to collaborate	http://data.europa.eu/esco/skill/580660a6-5d3a-421d-a54f-d85b706c2b2f
use online conventions of netiquette	http://data.europa.eu/esco/skill/97c1895a-a890-47da-abfc-79dc272add2e
collaborate through digital technologies	http://data.europa.eu/esco/skill/2b34a99f-9813-4c91-9509-b6b9b8c3132e
share through digital technologies	http://data.europa.eu/esco/skill/40001d93-8937-4859-89d5-2dca53290ff4
engage in citizenship through digital technologies	http://data.europa.eu/esco/skill/16a00c69-9c74-4c37-96d7-6301d285e5ce
interact through digital technologies	http://data.europa.eu/esco/skill/a12057b4-6d11-4a12-ab8e-15a028ef0a6d
manage digital identity	http://data.europa.eu/esco/skill/bc0b0b5d-f6be-405a-b224-b6902a4dbe97
use online communication tools	http://data.europa.eu/esco/skill/5f1dd9f6-dcb4-4384-88c9-f9f6a75305c9

4.3 Design pattern for OpenVM Credentials

Based on the design considerations described above, the fifth phase of the Design Thinking process – pattern development – focused on the abstraction of the designs into a generic design pattern for OpenVM credentials. The developed design pattern serves as general template for the design of a set of eight prototypes of open credentials in the OpenVM project, i. e. each prototype related to a particular OpenVM skill identified in Output 1 "Framework and Guidelines". This step has been important for quality assurance in Output 7 in the design of open credentials as the developed design pattern allows to create instances of OpenVM credentials following a standard pattern. The generative design pattern for open credentials in the OpenVM project have been described in the DeLFI 2018 research paper by Buchem (2018) titled "Design patterns for digital competency credentials based on open badges in the context of virtual mobility". The paper by Buchem (2018) describes the development of the design pattern and the design pattern itself.

The basic idea of Design Patterns is to describe a terminology of the essential concepts to support ork on recurring design tasks such as design of open credentials. Design patterns are comparable to knowledge structures in the form of cognitive problem-solving schemes (Kohls & Wedekind, 2008). There are different templates for the description of design patterns in context of learning and education. The challenge in

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[39] http://www.openbadgenetwork.com/

developing design patterns for a certain application context is to develop a logical structure which will guide the design of particular design instances (Kohls & Wedekind, 2008).

In the Open Virtual Mobility project, the basic design pattern for open credentials in context of virtual mobility was described as a structural pattern based on the metadata structure of the Open Badges standard. The OpenVM design pattern for open credentials represents a hierarchy in the form of a composite pattern. The pattern structure consists of three sub-patterns, i. e. (1) badge description pattern, (2) badge image pattern, and (3) badge didactics patterns. The element "competence framework" establishes a reference to existing competence frameworks and can be technically implemented at the metadata level in the Open Badges standard version 2.0 (Competency Alignment). The aim of the OpenVM structural pattern is to capture digital evidence of competence in its overall structure and to embed it in a didactic context. The following table displays the OpenVM design pattern for open credentials.

Table 2: The generic design pattern for OpenVM Credentials

Pattern element	Example "Media and Digital Skills"
1. Component: Badge description	
Name of the credential	Media & Digital Skills
OpenVM skill	Media and Digital Literacy
References to competency frameworks:	ESCO Framework http://data.europa.eu/esco/skill/aeecc330-0be9-419f-bddb-5218de926004
Possible levels	3 Levels: 1 "basic", 2 "intermediate", and 3 "advanced"
Badge description	The owner of this badge has demonstrated the ability to use resources effectively to learn; can assess the quality of resources and demonstrates "learner control". This digital credential is one of the Open Badges issued by Erasmus+ Open Virtual Mobility for successful demonstration of media and digital literacy either through participation in learning activities provided by the OpenVM Learning Hub such as OpenVM MOOC, or through any other evidenced activities in context of Open Education and/or Virtual Mobility.
Criteria for issuing	to be defined for each level
Target group	Persons with and without previous experiences in using digital media in international collaborations such as Open Education and/or Virtual Mobility
Issuer	Open Virtual Mobility Erasmus+ strategic partnership
Endorser	European Distance and E-Learning Network – EDEN
Consumers	Higher education, employers, general public

2. Component: Badge image	
Image form	Hexagon (Bestr template)
Image color	A combination of two colors of the OpenVM logo: green and yellow
Level	Name of the level at the bottom of the hexagon
Skill	Name of the skill in the center of the hexagon
Logo	OpenVM logo above the skill name
Image design	

3. Component: Badge didactics	
Learning context	Participation in the Open Virtual Mobility MOOC and/or evidence about using digital media in international collaborations in higher education
Task (what has to be done to earn badge)	Level 1: Take an automated e-assessment Level 2 & 3: Submit your e-portfolio with evidence
Evidence:	Level 1: Results of the e-assessment Level 2 & 3: User-selected evidences documented in e-portfolio
Assessment:	Level 1: Automated assessment Level 2 & 3: Peer-assessment including feedback on submitted e-portfolio
Pathway	From level 1 to level 3

The OpenVM Design Pattern template is used in the OpenVM project to express the designs of all OpenVM Credentials related to the 8 OpenVM Skills.

5. Next steps

The set of OpenVM credentials will be used for implementation and user testing in the Open Virtual Mobility Learning Hub[40] in milestone O5-A2.4: Implementation in the VM Learning Hub and User-Testing in January 2019. The design and planning of the first pilot related to the Media and Digital Skills is already under way. The Badging Toolkit (cf. Attachment 3) will be used to align the OpenVM credentials with the learning outcomes of the OpenVM MOOC including learning activities / learning tasks dedicated to the development

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[40] https://hub.openvirtualmobility.eu

of specific OpenVM skill sets as well as defining appropriate e-assessment methods and criteria, clearing how learning outcomes / learning achievements will be assessed and what type of evidence learners will need to submit to fulfil assessment criteria and earn OpenVM Credentials.

The OpenVM credentials will be also used to visualise student progress as part of the gamification strategy described in O5-A2. One use case being self/-assessing OpenVM skills of learners before and after taking the OpenVM MOOC, which can be visualised using spider web diagrams to highlight skill areas which have been already developed sufficiently and skill areas which need more attention (cf. Figure 10 below).
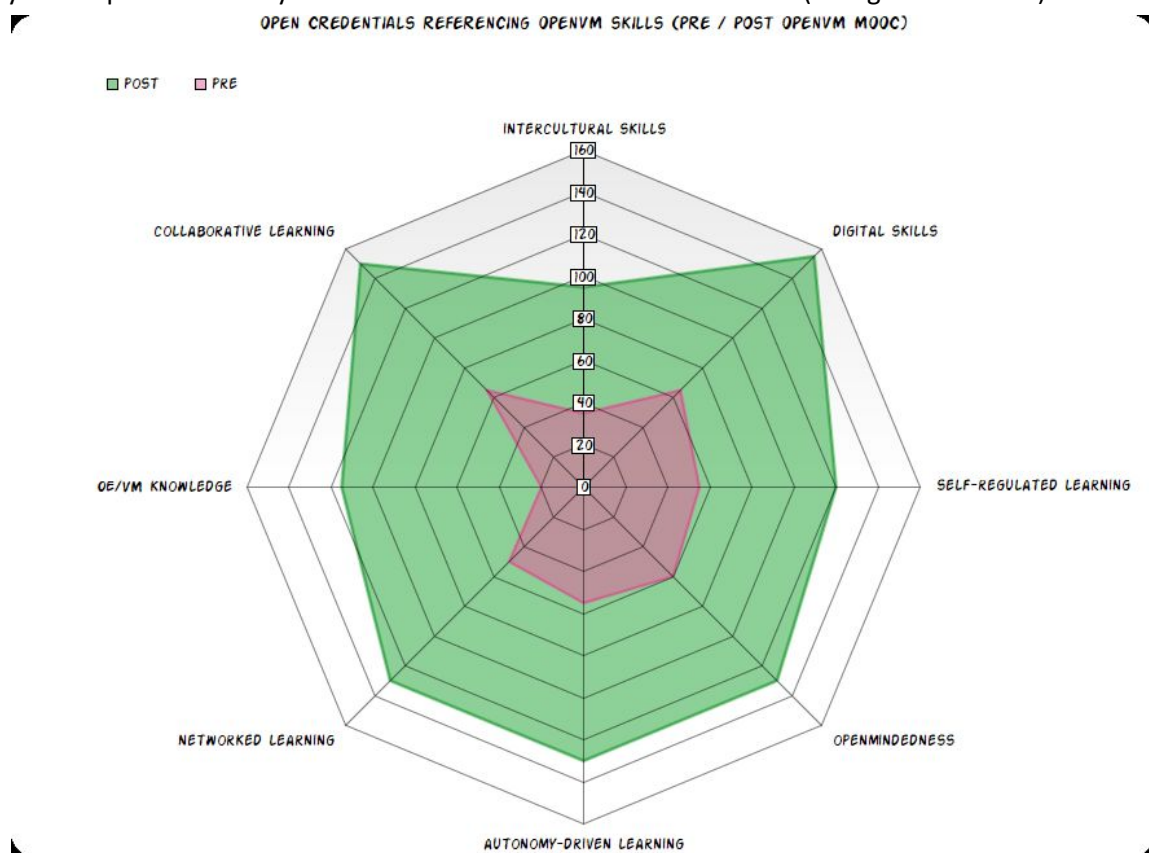

Figure 10: Exemplary visualisation of OpenVM skills before and after participation in the OpenVM MOOC.

The OpenVM Learning Hub is designed as a responsive web-application with loosely coupled components including the Bestr badging system used to issue and manage OpenVM credentials. A typical use case was described by Buchem et al. (2018) as follows:

"As a start, users will have the choice of general information and first-step guidelines about conducting virtual mobility at their own organization (targeting teachers and administration) or about finding and participating in existing VM opportunities (targeting students). Alternatively, users can directly open e-assessment resources to assess their level of expertise and experience. In case these assessments do not require upload of artifacts as evidence, the result can be evaluated automatically. Finally, different entry points to online learning courses, depending on the users information need and level of expertise, are offered. On enrolment to a course users can voluntarily fill out the group formation questionnaires to be added to one suitable learning group. If they do not provide such personal data, they are matched randomly. Their peer learning group is created for

assisting in task solving, actively responding to user forum questions, and the group is responsible for peer assessment and feedback which may be required to issue Open Credentials certifying VM skills.”

All relevant learning activities, outcomes and progress will be fed to an Experience API (xAPI). Open Credentials based on the Open Badge standard will be provided via the Bestr badging platform which will receive the xAPI records and - as soon as the user fulfills all criteria of a defined Open Badge - the user will be notified and the badge issued (Buchem et al., 2018). The official issuing organization is the Open Virtual Mobility hub. Endorsements by higher education networks such as EDEN are being currently discussed inside the partnership, together with endorsements by the partners themselves and other institutions which might be involved through dissemination.

6. Conclusions

The design of open, digital credentials in the OpenVM project has been a fruitful joint endeavor. The Design Thinking approach proved to be very effective in eliciting, collecting and refining ideas and prototypes. The tools used in the design process, including the Badge Design Canvas, the OpenVM Badge Design Template and the Badging Toolkit, have supported the process of understanding users and their needs, defining the design space oriented towards creating value for users, generating design ideas, prototyping, generalising designs into the generative open credentials design pattern and finally for preparing for implementation and user testing in the OpenVM Learning Hub. The challenge for the fourth milestone in output O5-A1 lies in the alignment of OpenVM skill descriptions developed in O1 with the competency repository developed in O3, e-assessment methods developed in O4 and learning outcomes for the OpenVM MOOC developed in O6. Further challenge for successful implementation and testing is the seamless integration of the Bestr badging system with the OpenVM Learning Hub in O2, including the implementation of the xAPI and LRS also to convey learning statements for the e-assessment tool.

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Attachments

Attachment #1: Badge Design Canvas[41]

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[41] https://drive.google.com/file/d/0By9JfART0xQ8dVdXT3VxY2NnRFE/view

Design your Badge Image

250 pixels
250 pixels

Design your badge image in paper form.

Your Badge Image needs to communicate your brand and what the badge is about. However, when the badge is online it will be very small so you need to think carefully about how you use the space effectively.

Things to think about:

- It will be hard to read text on the badge when it is small.
  Can you use icons/images to convey meaning instead?
- Your brand logo may take up a lot of space on the badge.
  Can you use colours and fonts to tie in your brand identity instead?
- If you badge is part of a series of badges how will you show they are connected?
  Do you need to represent different levels in your badges? Can you use colours to do this?
- Will your badge image appeal to your users?

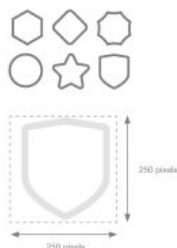When you have completed your design brief you need to create your badge images as **PNG** files *(with a transparent background).*

The Open Badge Academy platform contains a **Badge Image Designer** you can use.

Alternatively you can create your own badge design image *(PNG)* and upload this when loading your badge on to the OBA platform.

OBA   www.openbadgeacademy.com

Complete the Badge Template

| Badge Name | Badge Description |

This should clearly and concisely set out the purpose and value of your badge to a learner.

It should also explain what skills and behaviours the badge represents.

Task | 1   Add Title

Make a note here of any supporting media: Add Description and Evidence required

Task | 2   Add Title

Make a note here of any supporting media: Add Description and Evidence required

Task | 3   Add Title

Make a note here of any supporting media: Add Description and Evidence required

Task | 4   Add Title

Make a note here of any supporting media: Add Description and Evidence required

Task | 5   Add Title

Make a note here of any supporting media: Add Description and Evidence required

How will your badge be awarded and assessed?
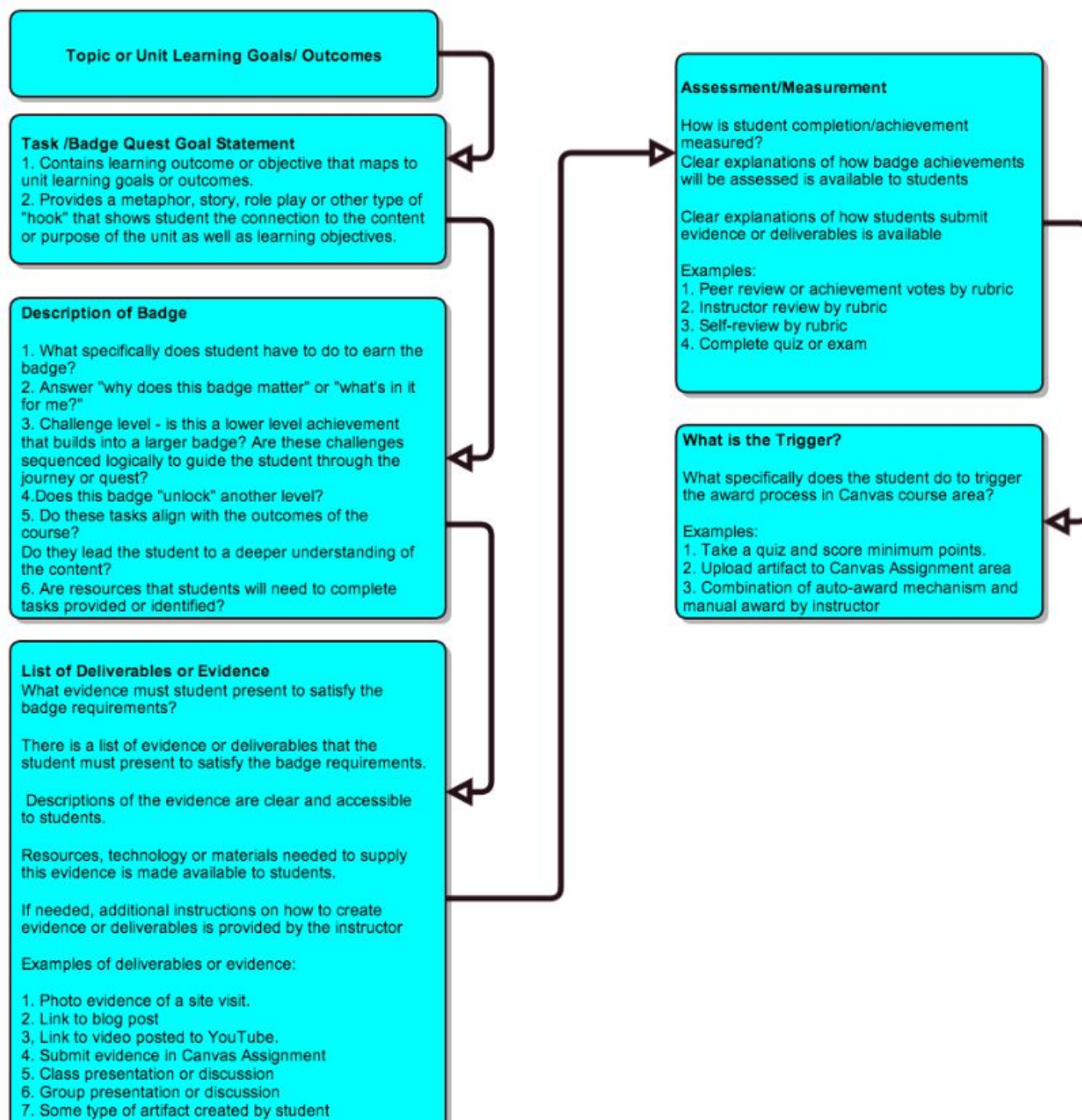
Attachment #2: OpenVM Visual Badge Design Template

Competency type 1:

TITOLO
—————
ISSUER

ANNO

- Badge name:

- Skills:

- Level:

- Criteria

- Task:

- Evidence:

- Issues by:

- Endorsed by:

Attachment #3: Badging Toolkit[42]

Topic or Unit Learning Goals/ Outcomes

Task /Badge Quest Goal Statement
1. Contains learning outcome or objective that maps to unit learning goals or outcomes.
2. Provides a metaphor, story, role play or other type of "hook" that shows student the connection to the content or purpose of the unit as well as learning objectives.

Description of Badge

1. What specifically does student have to do to earn the badge?
2. Answer "why does this badge matter" or "what's in it for me?"
3. Challenge level - is this a lower level achievement that builds into a larger badge? Are these challenges sequenced logically to guide the student through the journey or quest?
4. Does this badge "unlock" another level?
5. Do these tasks align with the outcomes of the course?
Do they lead the student to a deeper understanding of the content?
6. Are resources that students will need to complete tasks provided or identified?

List of Deliverables or Evidence
What evidence must student present to satisfy the badge requirements?

There is a list of evidence or deliverables that the student must present to satisfy the badge requirements.

Descriptions of the evidence are clear and accessible to students.

Resources, technology or materials needed to supply this evidence is made available to students.

If needed, additional instructions on how to create evidence or deliverables is provided by the instructor

Examples of deliverables or evidence:

1. Photo evidence of a site visit.
2. Link to blog post
3. Link to video posted to YouTube.
4. Submit evidence in Canvas Assignment
5. Class presentation or discussion
6. Group presentation or discussion
7. Some type of artifact created by student

Assessment/Measurement

How is student completion/achievement measured?
Clear explanations of how badge achievements will be assessed is available to students

Clear explanations of how students submit evidence or deliverables is available

Examples:
1. Peer review or achievement votes by rubric
2. Instructor review by rubric
3. Self-review by rubric
4. Complete quiz or exam

What is the Trigger?

What specifically does the student do to trigger the award process in Canvas course area?

Examples:
1. Take a quiz and score minimum points.
2. Upload artifact to Canvas Assignment area
3. Combination of auto-award mechanism and manual award by instructor

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[42] https://canvas.instructure.com/courses/826612/files/26095979?module_item_id=5382496

Badging Tool Kit - Peer Review Rubric

Item	Criteria	Peer Review Notes/Feedback
Task or Badge Quest Goal	Badge Goal gives a brief description of the goal of the task or quest and why it is important to the student	
	Goal contains learning outcomes or objectives that can be mapped to course objectives.	
	Goal contains a metaphor, story, role play or other type of "hook" that shows student the connection to the content or purpose of the unit as well as learning objectives.	
Badge Description		
	Outlines specifically what students have to do to earn the badge.	
	Answers "why does this badge matter" or "what's in it for me?"	
	Challenge level is identified- is this a lower level achievement that builds into a larger badge?	
	Challenges are appropriate for unit and are sequenced logically to guide the student through the journey or quest	
	Are resources that students will need to complete tasks provided or identified?	
	Tasks align with the outcomes of the course and lead students to a deeper understanding of the content	
	If badge is part of a larger system, is this made clear to the student?	
List of Evidence or Deliverables		
	Is there a list of evidence or deliverables that the student must present to satisfy the badge requirements	
	Descriptions of the evidence are clear and accessible to students?	
	Resources, technology or materials needed to supply this evidence is made available to students	
	If needed, additional instructions on how to create evidence or deliverables is provided by the instructor	
Assessment / Measurement		
	Clear explanations of how badge achievements will be assessed is available to students	
	Clear explanations of how students submit evidence or deliverables is available	
Triggers	Clear explanations of the Canvas badge award process is made available to students	