Virtual E-Learning Community Hub –
For Higher Education in the Raw Materials Sector

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Abstract

The "Virtual E-Learning Community Hub - For Higher Education in the Raw Materials Sector" caters to a central element of the European pillar of social rights, namely to enable high-quality education for all people, and is also in agreement with UNSD Goal 4. In today's transformation society, digitalisation is fast progressing and digital tools recurrently flood the market. A significant number of these tools have been developed for Higher education purposes and were widely used during the Covid-19 period. Digital literacy has increasingly become one of the most important skills in the majority of the world and those who are unable to keep up with the rapid transition into the digital era face the risk of reduced employment opportunities or social exclusion. The hub aims at providing basic training and information to HEI teachers and students to bridge the gap into the digital world, as well as, to serve with an adapted methodological-didactical framework to encourage auto-didactical learning at a high level, with an emphasis on the Raw Materials sector. This virtual hub will help to shift traditional educational paradigms and prepare today the T-shaped engineers needed for tomorrow. The realisation of the VECH is part of a successful research project.

Keywords
Digitalisation, higher education, learning and teaching methods, education for higher education institutions, virtual hub

1. Introduction
In today's transformation society (Schäffter 2001), the teaching of relevant and up-to-date skills is indispensable and represents a central element of the European pillar of social rights. Thus, transnational high-quality education should

be made available to all people, so that they can actively and self-confidently make a significant contribution as citizens to further development and ongoing innovation. The European Competence Agenda of the European Parliament (European Parliament 2016) makes it clear that Europe needs to narrow the gap in this respect since around 70 million people are neither able to read and write properly, nor do arithmetic, nor do they have digital skills and are, therefore, at risk of poverty, unemployment or social exclusion. The demand here lies in fundamental reforms of European education systems and their orientation towards future-oriented knowledge, skills, and competencies 'adapted to the digital age' (EUCO 14/17 2017). Since technological progress - keywords: artificial intelligence, robotics, IoT - is developing rapidly, lifelong investment in key skills and, above all, digital skills are required. The tertiary sector is particularly called upon to push ahead with sustainable reforms in terms of skills development and the incorporation of labour market trends to ensure the availability of next-generation professionals. Practical experience, new learning instruments, and materials, the use of digital technologies, and a lifeworld orientation must be incorporated into modern curricula (European Commission 2018). Under the postulate 'Industry 4.0', the permanently and rapidly developing digitalisation of the working world through the penetration of new technologies such as AR, VR, digital twins, etc. requires the implementation of new methodological-didactic teaching and learning settings, so to speak 'Education 4.0'.

Education represents a central investment in the future. Therefore, one of the main objectives is the permanent development and necessity of Life Long Learning (LLL) to ensure employability and competitiveness. Accordingly, an extension of the essential key competencies with regard to the inclusion of digital competencies is required to prepare the future experts of tomorrow for the challenges in their daily private and professional life. The education systems at universities should include new learning materials, systems, tools, and resources which on the one hand strengthen (online) cooperation and on the other hand, include the lifeworld orientation of learners and thus level out supposed socio-economic differences in performance. In addition, this approach can be used to increase equality of opportunity as well as to increase learning efficiency through the subjective reference to the motives and interests of the target group (European Commission 2020). In the framework of this project, implications for the successful implementation of digital education formats will be shown. In the action plan for digital education, the EU emphasises the need for reforms in the education sector, especially in view of the current COVID situation. The permanent flood of stimuli and information, which dominates our everyday life due to the penetration of digital devices and their services, pose a risk above all for us as active citizens and especially for future generations. Educational innovations are needed to create awareness of all generations with regard to critical thinking in and with the use of digital technologies and services (European Commission 2018). In this context, future research should focus on the investigation of holistic competencies profile in the context of industrial engineering education in higher education institutions for the engineers of tomorrow. New teaching and learning methods are needed to enable students to acquire the necessary transversal skills for the post-industrialised world. Higher education must provide future experts with future-oriented knowledge, skills, and competencies for maintaining competitiveness and strengthening the European economy. For all students, especially those in STEM (Science, Technology, Engineering, and Mathematics) subjects, the acquisition of extensive cross-sectional and key-competences is a major success factor. To carry out the project successfully and generate added value for the transformation of the European society into a "digital age", close interactions, exchange, and synergies between European partners are required. An international consortium enables a change of perspective through geographical and cultural complexity.

1.1 Project Partners

To carry out the project successfully and generate added value for the transformation of European society into a "digital age", close interactions, permanent exchange, and synergies between technical, economic, educational, and industrial perspectives are required. A unique mix of top-level cross-disciplinary science and education for the consortium is formed by three scientific and technical universities and one industrial partner from three different European member states. The consortium partners symbolise the diversity of Europe and thus enable a change of perspective through geographical and cultural complexity. Accordingly, the target group - students and teachers in higher education - will be enabled to focus on different contents from different perspectives and to enable cultural as well as transdisciplinary exchange. The project unites the European region in the South, the University of Bozen/Bolzano in Italy, with the geographical East, the National Technical University of Athens in Greece, and the Central European area by the industrial partner qoncept dx GmbH and the Montanuniversitaet Leoben. Even though the partners are located in very different regions of Europe, most of them have already cooperated and worked together on several projects, e.g. within the European Institute of Innovation and Technology (EIT), in joint study programmes, in Horizon2020 or Erasmus projects. Additionally, the Erasmus KA103 programme supported numerous Erasmus mobilities between the partners in the past years.

As can be seen from the respective descriptions of the partners, all of them already bring substantial experience from national and international projects and have an extensive interdisciplinary research and partner network with companies, research institutes, schools, and authorities. In addition, the partners were selected based on their expertise in the respective discipline and also on their previous collaborations. The University of Bozen/Bolzano and the Montanuniversitaet Leoben have a long-standing excellent cooperation in a variety of projects and research activities, such as the international H2020 project "SME 4.0". qoncept dx GmbH as an industry partner is also involved in close cooperation with the Montanuniversitaet Leoben and various EIT Raw Materials projects such as "TrainESEE" or "RM@Schools" as an industry advisor and is, therefore, familiar with international project management and consulting tasks. The partners of the School of Mining and Metallurgical Engineering of the National Technical University of Athens in Greece are involved in a large number of projects on a national level in close collaboration with stakeholders from industry, authorities, and research institutions, and also on an international level as project partners or consortium leaders. NTUA in Greece and the Montanuniversitaet Leoben have a long-standing, extremely successful, and proactive cooperation in the raw materials (RM) sector including a number of EIT Raw Materials projects, such as, "EnAct-SDGs", "Train ESEE V2", and "RM@Schools ESEE". The consortium unites the knowledge triangle of science and technology, business, and higher education and promotes the transdisciplinary exchange among each other. Thus, the key drivers of the work packages are education, research, innovation, transversal skills, and dissemination and ergo contributes significantly to the further development of the European higher education sector and consequently to SDG 4. The main aim of this project is to expand existing cooperation networks, learn from the cooperation experience, and take it to the next level and grow them stronger together than ever before. All partners have committed to significantly strengthening all collaboration activities and are convinced that only a pan-European and transdisciplinary approach can support the transformation towards a "digital era". By including associated partners who provide input and feedback on the results of the individual work packages, an immense added value for the project can be generated. The involvement of associated partners is multifaceted and they provide the project with various levels of input, such as providing data, acting as an external sounding board and ambassador, and partaking in a training session(s). The consortium, together with the associated partners, provides a firm foundation for pertinent exchange, focus, and ensuring that project impact is transnational and sustainable.

2. Objectives

The focus of this project lies in the freely accessible provision of appropriate technical and pedagogical materials for the training of digital literacy, both for teachers in higher education and students. On the one hand, the aim is to identify digital competencies and needs based on extensive research work. As a first step, a systematic literature search will be carried out in order to define the state-of-the-art. A first preliminary search on Scopus has shown that only 39 documents have been published on these issues in the years 2017-2020. This fact underlines the need for further research in this field in order to further promote the professionalisation of digitalisation in the tertiary sector. The status quo is to be ascertained in the course of further investigations by means of extensive questionnaires, interviews with key stakeholders from business, industry and policy makers, as well as the survey of technical equipment at the participating universities of the consortium and other associated partner universities and institutions. The resulting identification of educational needs, considering the prevailing conditions of the individual educational institutions, will be used to identify measures for further professionalisation. The already existing digital methods and tools are to be systematically examined by means of a coherent approach and the respective functions, characteristics, special features, such as, advantages and disadvantages of use are to be surveyed in order to be able to determine the status quo here as well. Furthermore, a SWOT analysis will provide information about potentials, strengths, weaknesses and possibilities with regard to the current use and possible applications of digital tools. Based on the empirical studies, the project will present an openly accessible digital handbook using a virtual platform of a MOOC, tutorials, webinars and materials for teachers and students on the topics of digital media competence, digital security, digital well-being and digital teaching and learning. A train-the-teacher programme for the use of digital media and its implementation in teaching will also be designed and subsequently implemented on the basis of the data collected for all partner universities and associated partners. This programme will be designed as an online format, methodologically and didactically based on learning outcomes and will be concluded by a final assessment according to the constructive alignment approach of Biggs (2011). For the increased visibility of digital competences, a certificate will be awarded upon successful completion of the programme. The platform 'Virtual E-learning Community Hub - VECH' is designed to make all results available to the target group and users. In particular, this hub includes a so-called "digital handbook" with general information about the state-of-the-art and the status quo of digital competences and their possible applications. This "digital handbook" also contains a detailed overview of digital media, tools and services, their usability and applicability. The third section of the handbook deals with the didactic-methodological perspective of

digital tools in the context of tertiary education formats. Included here are both the professional use of these tools as asynchronous or synchronous teaching media, as well as, suggestions and advice for online lectures for teachers and students.

In addition, there will be a separate tab for teaching and learning materials, which will be freely accessible to everyone and free of charge. The educational demands of industry and society are evolving constantly and must therefore, be adapted to the current situation in which the use of digital tools has increased steadily at all levels of education within the European Union and also in an international perspective. These materials, tools and devices are transforming teaching and learning processes, providing new learning opportunities for students and creating (new) learning paths for both teachers and students at universities in a world characterised by ongoing issues such as digitalisation, automatisation, glocalisation, epidemics and environmental catastrophes. As a new virtual learning platform, the VECH, therefore, combines these needs by embedding the state-of-the-art teaching and learning methods for students and teachers to bridging the gap between traditional teaching methods and digital natives.

In order to ensure the community character of this hub and to guarantee exchange, this platform offers a forum function. Thus, transdisciplinary discourse can be ensured. This hub, as a digital e-learning platform, simultaneously functions as part of the marketing and dissemination plan by presenting the research results to a wider public. Accordingly, on the one hand, materials and instructions on how to use digital devices and learning settings are published, which in turn increases the quality and professionalism of digital education. On the other hand, the possibility of MOOCs and the associated certification ensures and promotes the visualisation of digital competence. Another important aspect is the opening of the education systems to a wider population, which in turn promotes the sustainable use of the hub. The consortium partners see this platform as an essential service for teachers, and above all, for students. The hub will be implemented into the organisational structure of the Montanuniversitaet Leoben to ensure for a centralised place of maintenance and operations
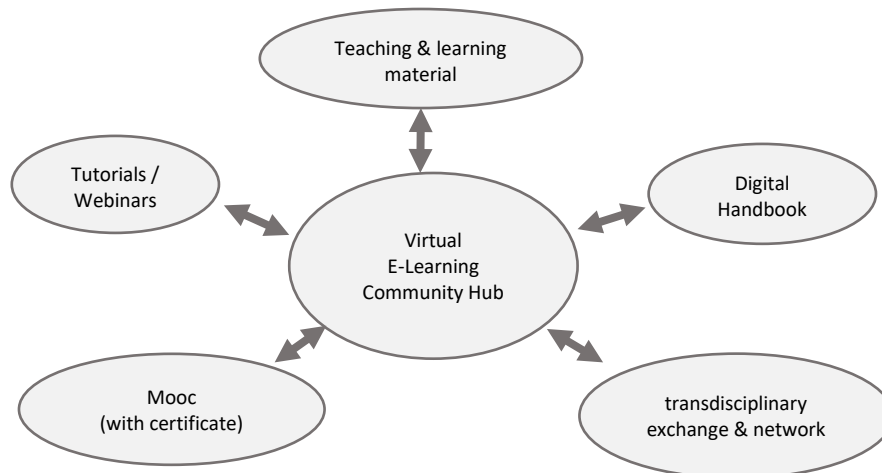

Figure 1. Virtual E-Learning Community Hub

3. Target group

University teachers and students are the main target group, especially those in the RM sector. Teachers have the opportunity to train themselves online in the applicability and implementation of digital teaching methods and thus reflexively develop their own teaching activities. Furthermore, these freely accessible teaching and learning materials and information represent innovative educational materials developed according to the latest state-of-art research in educational science and based on the method of constructive alignment. Accordingly, preparation, implementation and final assessment criteria are coordinated and methodologically and didactically adapted to the target group. For students and prospective experts, the publication of the materials thus opens up an online learning and experimental space that can be planned individually and is freely accessible at any time. The various methodological-didactic learning tools, such as asynchronous applications, enable practical testing and thus facilitate the transfer of knowledge from theory to practice. In addition, students have the opportunity to acquire demonstrable tools for working with digital materials, tools and applications within the framework of a MOOC. Supporting didactical material will be developed for the training sessions, the MOOC and Virtual Hub in general. This two-fold approach provides material

for the teaching and learning pathways in HEIs and also, provides material on how to maximise the use of the VECH. Through the use of asynchronous applications, the students are able to apply their specific theoretical knowledge gained from their studies in the practical field, providing them with the opportunity to train their competencies.

4. Innovation

An integral part of the virtual HUB is the development of a MOOC and training sessions for training purposes, continuing education, and education of digital skills based on the needs of industry, academia, and research for teachers and students in the raw materials (RM) sector. In the run-up to these courses, the second intellectual output includes a comprehensive quantitative and qualitative research methodology to illuminate and highlight current educational needs from different perspectives and, in parallel, a systematic literature analysis of the skills required to work in and with digital services, tools, and methods. A SWOT analysis will then provide information on the strengths and weaknesses, as well as, the opportunities and threats regarding the use of digital methods and tools in higher education. Finally, a gap analysis will be carried out to identify implications for the subsequent development of the course content.

In accordance with the state of the art and the opinions of the key stakeholders, the content of the MOOC will be adapted to the target group in order to close the identified gaps and avoid mismatches. These massive open online courses are freely accessible and are professionally developed and conducted methodically and didactically based on the theory of constructive alignment. In the third intellectual output, the content and scope of the first MOOC will be designed on the basis of previous research and surveys. After successful implementation into the online platform, the MOOC can then be started.

In the run-up, the courses will be advertised via various communication channels and the anticipated learning outcomes will be presented. Participation is open to everyone and free of charge. After successful participation in all modules and a final assessment of the learning outcomes, participants receive a certificate as proof of their digital skills development. This digital course thus also contributes to the visualisation and validation of digital competencies. The implementation of the virtual e-learning community hub in the university sector follows the demand for innovative solutions in this area, as this platform ensures both interdisciplinary and international exchange through a forum and also includes a so-called "digital handbook", which can be used by teachers and students as a source of information on topics related to digitisation in the university sector. Furthermore, the platform contains tutorials, webinars, and other MOOCs for the entire raw materials sector with different focal

points, such as sustainability or recycling management. For teachers and/or prospective research assistants in the university sector, the platform offers the possibility to download free teaching and learning materials and/or upload specially prepared materials by the operators.

An important aspect of innovation is the sustainability of this HUB. Within the project, the participating partners have the opportunity to implement this platform in the organisational structures of the respective universities. The Montanuniversitaet Leoben, will carry out this implementation within the university's own competence center for education and will take over the coordination and administration of the HUB throughout the project duration and thereafter. Thus, this platform will be available to teachers, students, and university institutions free of charge even after the end of the project.

Another important innovation factor of the project is the synergistic effect on knowledge transfer on a municipal or regional scale, as all partner universities have a similar academic structure and are active in regional areas with great diversity. This knowledge transfer manifests itself, for example, through a significant positive impact on the different networks of universities, UBC, teaching and learning methods, courses, or on the students and the academic staff themselves. The knowledge transfer is considerably facilitated by the use and implementation of the VECH.

The project is set up in the four phases of project management: initiation, planning, implementation and closure. By orienting the project along these four phases, the first step is to understand the goals, priorities, deadlines and risks of the project. Once these parts are covered, the specific tasks will be outlined and placed into a timeline. As the project is in progress, regular monitoring and evaluation is necessary with the focus put on communication and dissemination. When the project ends, the results and key learning will be summarised and analysed in order to sustainably use the created output. The project management has the responsibility of providing overall leadership for this process, which means ensuring competency, accuracy and timeliness. The responsibility of the project leader is also to share information with stakeholders and utilise it for informed decision-making and improved programme quality. However, the work package leaders are experts who will collect and process the information necessary for fulfilling the tasks of their work package and thus, the active involvement of all partners and stakeholders can be secured. The project activities are set up in a logical, bottom-up way, where every task builds on another. In the initiation stage, the needs of the local, as well as, the European community will be analysed and then further developed during the primary stage

of the project. All partners will identify the current state of the art of digital education and digital competencies in their respective countries and examine the already existing digital methods and tools. Based on the empirical studies, the project will present an openly accessible digital handbook using a virtual platform of MOOCs, tutorials, webinars and materials for teachers and students on topics such as digital media competence, digital security, digital well-being and digital teaching and learning. All steps will be monitored regularly and quarterly consortium meetings ensure that all partners are on track with their respective tasks.

5. Research Methods

The innovative strength of this project lies in the comprehensive provision of freely accessible learning and working materials with regard to the development of digital competences in higher education. The Hub offers university teachers and students the opportunity to acquire digital skills on the basis of MOOCs and allows them to obtain a certificate as proof of their digital competence. The international networking opportunities between universities, stakeholders, teachers and students should also be highlighted. The regional dimension can be seen as an innovation, as this project is designed for the whole of Europe and brings together partner universities from the geographical areas of Europe: South, East, and Central Europe. In accordance with the transdisciplinary approach and the geographical and cultural diversity of the consortium, the development of transversal skills is targeted. Through the novel digital methodological-didactical teaching and learning methods and applications, the basis for a skill-set will be created, which will develop skills in languages, cultures, European identity, and STEM subjects with a focus on sustainability and resource conservation. Teachers and students from all European countries will be enabled to acquire (new) interdisciplinary skills such as soft skills, digitalisation and digital teaching and learning methods and to create awareness for the handling in and with the digital world. Complementary to these research services, the project is intended to generate added value for the European Higher Education Area due to the multidisciplinary consortium by amalgamating the different perspectives, experiences and research results. This will ensure the exchange of experience, materials and best practice across geographical borders and will enhance the innovative strength of all participating countries. During the two-year duration of the project, a foundation for a digital inclusive, borderless and integrated European education is to be laid in order to produce competent and well-trained graduates and university teachers. This will make a significant and innovative contribution to the current European social, economic and ecological challenges. Furthermore, the project promotes the principle of lifelong learning and equal and excellent education according to SDG number 4 "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all".

The methodology that will be used in the project management is based on active, transparent, and collaborative structures and common decision-making procedures that will involve every partner in the project management and implementation of the outputs, activities and set milestones. The project activities have been divided into 5 Work Packages to complete the project objectives. Each institute utilises the grant to coordinate and manage the tasks as given in the WP structure below. All partners are involved in each of them and will be responsible for communicating progress with each other, which is coordinated by the lead partner:

- WP1 – Project Management: The main objective of this WP is to guarantee the success of the project, its quality of implementation, effective management of all contractual issues and to assure that the project is executed in accordance to the defined budget and schedule. Within the scope of the first work package, all consultations and agreements are also handled.
- WP2 - Digital Handbook: The main objective of this WP is to identify current educational needs of the RM sector, state-of-the-art of digital skills, services, and tools, based on the involvement of key stakeholders and comprehensive qualitative and quantitative research methods. The final step will be to identify strategies for incorporating innovative digital educational tools into teaching.
- WP3 - Education 4.0: The main objectives of the third work package are to incorporate the results and implications of the second work package into the development of didactic support material and teaching concepts e.g. train-the-teacher programs. Identification and provision of appropriate system requirements for the platform to ensure its proper functionality. Development of a simulation game that can be used as an example for active learning with simulations in engineering education.
- WP4 - Development & Sustainability of the HUB: All previous work packages serve as an essential basis for the realisation of the HUB and the sustainable implementation into the organisational structure of the Montanuniversitaet Leoben. Identification and provision of appropriate system requirements for the platform to ensure its proper functionality. The HUB will be integrated into the in-house Competence Center and will

be used in teaching, training and further education. Thus, the use and permanent administration of the HUB is guaranteed.

- WP5 - Fostering digital literacy: The main objective of this work package is twofold. Firstly, to promote digital literacy in HEIs through a comprehensive dissemination strategy. This includes an immersive marketing & communication plan to ensure the targeted dissemination of information, materials, project progress and results. Secondly, a major output of this project is the methodological-didactical training programmes. These programmes are effectively used as an essential part of the dissemination strategy to create target group interest in the HUB and to demonstrate the necessity of using digital approaches and services. The goal is to provide the methodology to HEIs for using digital methods and tools in teaching.

6. Expected impact and Discussion

The expected impact of the VECH project, by merging into a strategic partnership, will include professionalization through the integration of digital teaching and learning concepts and innovative pedagogical approaches into European-wide higher education with a focus on engineering education in the RM sector. These innovative methodological-didactical learning concepts are a combination of identified future relevant digital skills for (prospective) professionals in the RM sector and the demand for innovative learning settings
to enable holistic teaching and learning. Furthermore, the close cooperation of the strategic partnership with different stakeholders such as industry, academia, policymakers or associations enables a holistic insight into the requirements and needs of future experts in the RM sector by incorporating the various perspectives.
Especially in today's globalised world the topic of digital education in HEI's can open up a whole new world of comprehension and methodological flexibility. With the incorporation of various tools, materials from the hub as well as hub itself, the way of teaching will change as teachers will be able engage their students in a more effective way and offer to their students an enriched content repertoire, as well as, a heightened comprehension opportunity. Through the incorporation in the learning and teaching culture of the universities, students will see their discipline from a widened and more in-depth perspective which will have an influence on their career path. The new way of learning will result in an intensified perception of their work environment and more intensive grasping of their discipline and thus the way they will handle their discipline will become more effective. Accordingly, it opens up the opportunity for individual students to develop the necessary transversal skills and competencies to promote individual and collective competitiveness in the labour market and, in addition, to develop both professional competence through a holistic view through innovative study programmes and the overall personality. The resulting increase in the number of very well-educated graduates can in turn ensure further development of the diverse fields of work, the technologies, processes and specialisation used in them along the value chain and thus the global economy through the application of innovative solutions, ideas or developments. This in turn brings considerable added value for the entire economic sector, both on a regional and national, as well as, on a European and international level, as these sectors are dependent on future t-shaped professionals equipped for a rapidly changing environment. A major goal of this partnership is also to make a significant contribution to achieving the ambitions of the European Union. By enabling a holistic perspective with regard to content, expertise and key competencies in the field on the one hand and the international networking and communication capabilities opened up by the virtual hub on the other hand, as well as the exchange of best-practice examples, the partnership contributes to the increase of equal opportunities and gender justice and to the progress of innovation in individual countries as well as Europe as a whole. Thus, VECH makes a significant contribution to the UN sustainability goals, and in particular, goals 4, 8, 5, 10, 17. The VECH platform also follows the demands of the European Commission in the action plan for digital education in that the digital competencies of participants in the free and freely accessible MOOCs are validated by a certificate and thus, contribute to the visibility of competence developments, open up education systems and enable innovation in higher education. So, this partnership will establish a solid base for the future programme studies and collaborative research projects between recognised institutions. These organisations will exchange knowledge, skills and best practices from their respective countries, thus promoting the development of a new European dimension in engineering education curricula. Regarding quantitative perspective, the impact will be recognised by the number of innovative learning and teaching concepts and educational materials, tools and services mainly for students and teachers. Similarly, the quantitative impact regarding research area will be recognised by the number of new cooperation agreements with research and education entities and a number of new project proposals initiated by the VECH consortium.

7. Conclusion

A significant influence due to the strategic-geographical orientation of the consortium includes the geographical dimensions of Europe and beyond. The close cooperation and the networks on local, regional and (inter)national level of the participating organisations allow a horizontal dissemination of the results and above all, the incorporation of the virtual hub into the research work. The use and implementation of the virtual hub will also considerably facilitate the supra-regional transfer of knowledge. The overriding (international) goal beyond regions and geographical borders is professional training through the implementation of skills and competence required in the future, in order to be able to react already now to the changing conditions on the world market and thus to train the engineers of tomorrow. Ergo, the second action of the European Commission "Strengthening skills intelligence" (European Commission 2020) is supported. In addition, this action will also be followed up by making digital competencies visible, as certification will ensure international comparability and validity. These proven skills can then be entered autonomously into the personal CV or Europass by the graduates of the MOOCs on the virtual platform.

- Additional influence at regional level:

An essential innovation factor of the project at the local or regional level is the synergistic effect on knowledge transfer, since all partner universities have a similar academic structure
and are active in regional areas with great diversity. This knowledge transfer manifests itself, for example, through a significant positive impact on the different networks of universities,
UBC, teaching and learning methods, courses or on the students and the academic staff themselves.

- Additional influence at national level:

All partner universities are in close contact with national institutions such as ministries, associations or federations and are often involved in national projects with interdisciplinary
partners. By using the virtual hub within these consortia, further proactive dissemination can take place, thus informally increasing the level of awareness of the project and the project
results considerably. This factor contributes considerably to the action "EU support for strategic national upskilling action" (European Commission 2020) initiated by the European Commission.

Especially in today's globalised world the topic of digital education in HEI´s can no longer be detached from the idea of teaching students in a classroom, as a blended/hybrid or fully online format. It opens up a whole new world of comprehension and methodological flexibility. This is the reason for this pan-European consortium under the lead of MUL to take initiative and enhance teaching standards in Europe to a digital and much needed level, together as competent and complementing partners. Only through the integration of digital concepts into teaching lasting solutions for the industry can be created. The consortium is home to in-depth knowledge of content and design of engineering education, the necessary technical expertise regarding digitalization in education as well as experience in connecting the technology with pedagogy and the competence to market the finalised product. It can thus provide the required expertise to create a new digital top-notch education system for Europe for the benefit of the RM sector.

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5. Biographies

Corina Pacher is an Education Project Manager at the Resources Innovation Center in Leoben. She studied pedagogical and educational science at the University of Klagenfurt with a specialization on social and inclusive education as well as on professional education. During and after her studies, she gained work experience, e.g., as the head of educational programs and in different social public service enterprises as social education worker. Currently,

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Mariaelena Murphy is the Education Portfolio Manager at the Resources Innovation Center in Leoben. She holds a Master degree in Business Ethics and Social Responsibility. She worked as a Senior Lecturer at the Hanze University of Applied Sciences for 17 years specialising in the Management discipline, also with a focus on cultural competences through the creation and involvement in learning-labs. Alongside this, she was actively involved in cross border projects connecting education, business and communities. Currently, her focus is on (co)creating partnerships and projects that implement new teaching & learning pathways that promote a transdisciplinary approach in connecting research, education, business and society for the future of T-shaped raw material engineers.

Erwin Rauch is an Assistant Professor in Manufacturing Technology and Systems at Free University of Bolzano, Italy. He was Visiting Researcher at Worcester Polytechnic Institute (WPI) in Worcester, MA (USA) and Chiang Mai University in Thailand. Further, he is Head of the Smart Mini Factory laboratory for Industry 4.0 application at the Free University of Bolzano. His research interests include industry 4.0, axiomatic design, agile and reconfigurable manufacturing systems as well as engineering education 4.0.

Katerina Adam is an Associate Professor, School of Mining and Metallurgical Engineering, NTUA, holding a M.Sc. and PhD from the U of Minnesota. She has more than 35 years' experience in the Raw Materials Sector, in Academia, RTOs and Industry. Her Research interest lies on Project & Environmental Management, Sustainable Development of Mineral Resources and Education in Raw Materials. She has coordinated/participated in more than 50 National, and European funded research projects including a number of EIT RawMaterials Education projects. She is the Education Advisor of the EIT Raw Materials Hub – Regional Center Greece and a member of the EIT RM ESEE Education Working Group.

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