

# “Ecosystem for European Education Mobility as a Service: Model with Portal Demo (eMEDIATOR)”

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## INTERNAL REPORT 6: Technological component of the portal

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## Abbreviations and Acronyms:


## Content

Content.....	4
1. A6.1. 6. Development of model of learner needs and industry partners needs (UL) .....	8
1.1. Educational needs of children and young people .....	8
1.2 Educational needs of adults.....	10
1.3 Educational needs of industry partners.....	11
REFERENCES .....	16
LIST OF AUTHORS.....	17
2. A6.1. Extra. 7. Development of Interactive training material for Training Event (UL) .....	18
LIST OF AUTHORS.....	21
3 . A6.2 6. Development of model of certification of learning outcomes on the portal (TSI).....	21
2.1 State the Objective of the Report in Exploring the Model of Certification of Learning Outcomes on the EaaS Portal.....	22
2.2 Evolving Landscape of Education and the Shift towards Digital and Online Learning Platforms.....	23
2.3 Importance of Certification and Credentialing in Validating Learning Achievements.....	25
2.4 Concept of Certification of Learning Outcomes and its Role in Recognizing Learner Achievements	26
2.5 The difference between traditional degrees and digital credentials.....	28
2.6 Concept of Certification of Learning Outcomes .....	30
2.7 Components of the Certification Model.....	32
2.8 Digital Credentials and Their Attributes.....	33
2.9 Implementation and Challenges .....	35
2.10 Impact and Future Implications.....	36
2.11 Conclusion .....	39
REFERENCES .....	39
LIST OF AUTHORS.....	41
4 . A6.2 Extra 7. Analysis of the impact of AI on the competencies of university graduates (TSI) ...	41
2.1 Historical Review .....	42

2.2 TITLE Artificial Intelligence, and new competencies of university graduates.....	45
2.3 Model of university with artificial intelligence .....	47
2.4 Conclusion.....	50
REFERENCES .....	50
LIST OF AUTHORS.....	52
5 . A6.3 Development of model for competence-based industry mentoring (UMU).....	53
5.1 Introduction .....	53
5.1.1 Background .....	54
5.1.2 Importance of competence-based education .....	55
5.2 Proficiency in career advancement.....	56
5.2.1 Essential Skills for Career Success .....	57
5.2.2 Acquisition of knowledge and useful skills .....	58
5.3 Framework for competence-based industry mentoring .....	59
5.3.1 Guidelines for Successful Mentoring.....	60
5.3.2 Enabling mentors to connect with skilled experts.....	62
5.3.3 Promoting an adaptive educational setting.....	62
5.4 The mutually beneficial nature of mentorship.....	63
5.4.1 Mutual gains from information sharing.....	63
5.4.2 Establishing robust mentoring relationships.....	64
5.5 Anticipated results .....	65
5.5.1 Strengthening career advancement .....	66
5.5.2 Knowledge transfer optimisation.....	66
5.6 Conclusion.....	67
REFERENCES .....	67
LIST OF AUTHORS.....	68
6 . A6.3. Extra 7. Automatic processing of natural language competences for DEMO application (UMU)68	
3.1 Introduction .....	68

3.1.1 Natural language processing overview.....	69
3.2 Academic competences .....	70
3.2.1 Integration of NLP in an educational setting.....	71
3.3.1 NLP in business communication.....	71
3.5 Conclusion.....	74
REFERENCES.....	75
LIST OF AUTHORS.....	75
7 . A6.4. 6. Implementation of User Client mockup (UoI) .....	75
4.1 Technologies and Frameworks.....	76
4.2 Backend Integration .....	77
4.3 Architecture.....	77
4.4 Integration with the eMEDIATOR Portal .....	79
4.5 Integration phase with Moodle.....	82
4.6 Registration .....	83
4.7 Conclusion.....	84
REFERENCES.....	85
LIST OF AUTHORS.....	85
8 . A6.4. Extra 7. Development of AI embedding in the portal technology and architecture (UoI) .....	85
4.1 AI Embedding .....	86
4.2 MOOC Integration .....	87
4.3 Content Enhancements.....	88
4.4 Project Showcase: Automating Course Descriptions.....	89
4.5 Conclusion.....	93
4.6 Next Steps.....	94
LIST OF AUTHORS.....	95
9 . A6.5.6. Formation of conclusions and recommendations for the further development of the portal. (AU) .....	95
LIST OF AUTHORS.....	96

10. A6.5. Extra 7. Design of GUI (Graphical User Interface) for DEMO Application (AU) .....	96
5.1 General.....	96
5.2 Old Version .....	97
5.3 Architecture and general overview.....	97
5.3 Wordpress.....	98
5.4 Moodle .....	98
5.5 OAuth2.....	98
5.6 Website Structure .....	99
5.7 Courses .....	102
5.8 Code Documentation and technical details .....	103
Moodle Docker yaml file.....	105
Course Finder Script.....	113
LIST OF AUTHORS.....	120

# 1. A6.1. 6. Development of model of learner needs and industry partners needs (UL)

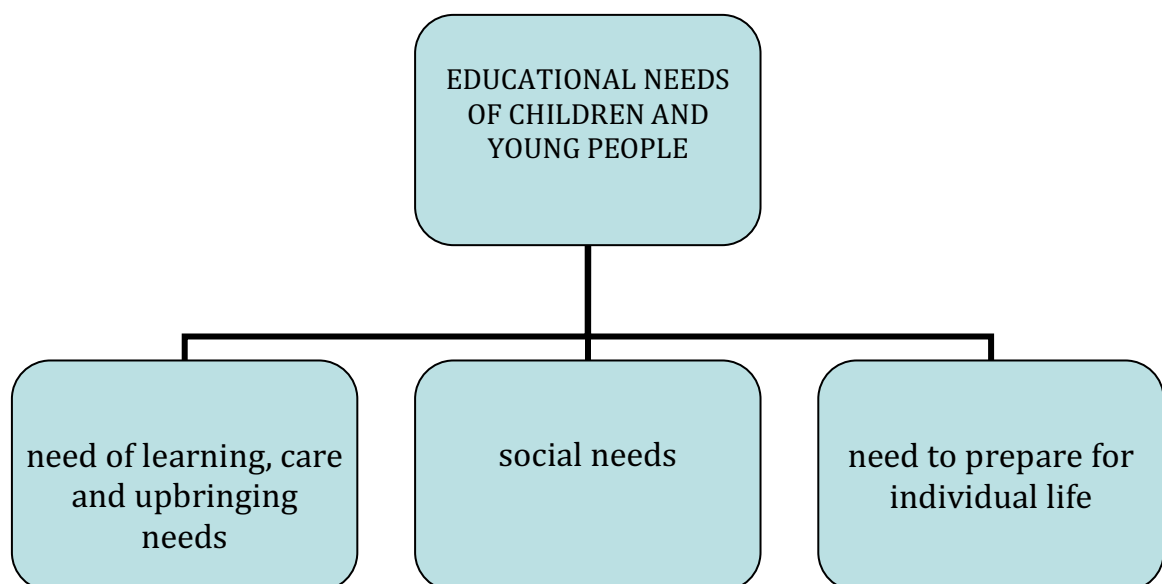
## 1.1. Educational needs of children and young people

Nowadays, children from the first days of life function in the environment of digital technologies and virtual world. ICT and digital tools create an environment in which a children and young persons develop, is brought up and educated. For children and youth technologies are “natural” part of life, they interact with them on a daily basis and long before they start school education, they use the benefits of technology intuitively. In the era of dynamic technological changes, the education must adapt to the requirements of young people and take their needs into account.

In this chapter we analyse and present the needs of children and young people associate with digital education.

The educational needs of children and youth have been defined and overarching goals which, through the implementation of tasks, will enable the development of students in line with the needs of the digital society and students' expectations.

**Figure 1: Educational needs of children and young people**





### 1.1.1. Learning, care and upbringing needs

Children and young people have a need (although they may manifest it in different ways) for a scientific interpretation of their own perceptions, perceptions and life experiences. Scientific knowledge remains for life as a set of rational, logical principles and methods thinking about the world and people. The tasks resulting from this function are not only the acquisition of information, but also intellectual development and the acquisition of cognitive competences, broadening mental horizons, remembering messages and processing them. In addition, it is solving problems of varying difficulty and complexity, mortgages, developing interests, exploring one's own capabilities, developing materials on a selected topic, searching for information from various sources in the modern world full of information, images and digital technologies.

### 1.1.2. Social needs

Social needs can be formulated both from the point of view of students and society. These needs consist in educating a conscious citizen, a member democratic society, socialized man and world citizen. A conscious citizen is a great value of every society, every state, every nation. Social education requires conscious acquisition knowledge and experience related to the past and present as well as the prospects for the development of society, state and nation, respecting universal values and the global world order.

### 1.1.3. The need to prepare for individual life

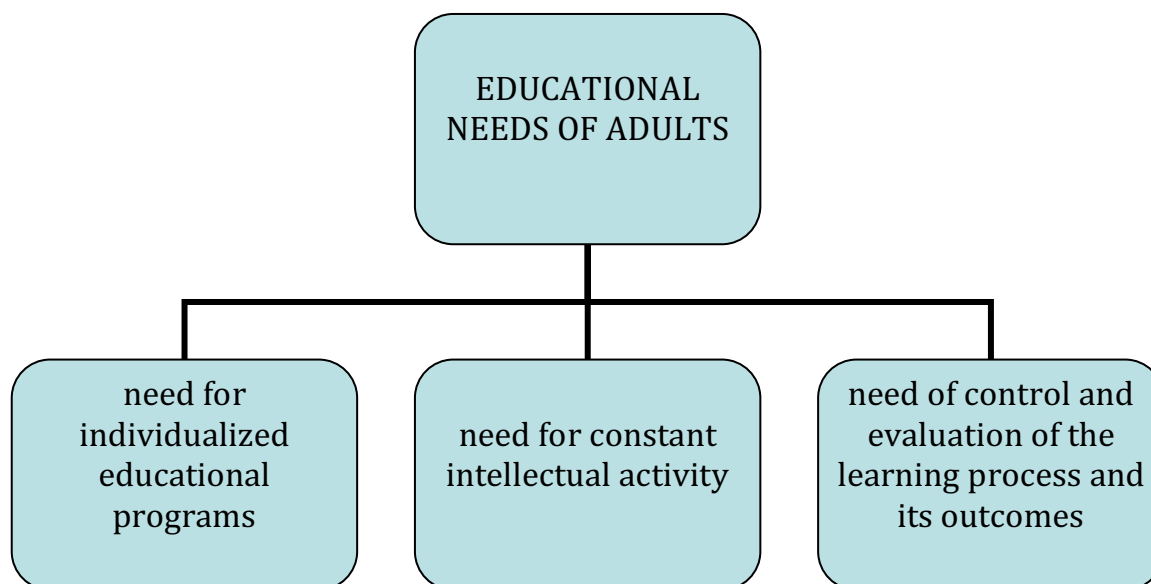
Another important need is inextricably linked with preparing young people for life in modern society. The young man brings to social life as much as he is worth. His value depends on his communication abilities with others, health, cultural and educational needs, experiences, social and cultural initiations, creativity, commitment and character. Pupils have a need to master language communication (both in their mother tongue and foreign languages) and to develop their interests and creative passions. Education introducing students to the science world, it cannot neglect the introduction to culture. Culture includes the entirety of the material and spiritual achievements of humanity, produced and constantly multiplied in its historical development. Education enables the growing of the young man into culture through teaching artistic subjects, technical and any other, and through various forms of collective and individual education. Among the fields of culture, privileged place takes arts. Contact with art will enable not only teaching literature and other artistic objects, making native ones available and world achievements in the art of words, theatre, cinema, music, painting, sculpture or architecture, but also different forms of individual work, activities of interest clubs and youth organizations, youth attendance at the theater and cinema, visiting excursions, exhibitions, displaying the creative achievements of young people at school and in the wider community.

The fulfillment of the needs of individual life is expressed in a good orientation in action in the world of growing social and cultural tensions. Thus, I implement the idea of both common and individual good.

## 1.2 Educational needs of adults

The educational needs of adults are generated by many factors, especially previous biographical experiences, mental life of the individual and cultural conditions. They are usually perceptible, subjective, but they assume a hierarchical arrangement. Failure to meet the educational needs of adults inhibits their process personal and professional development, may lead to a weakening of their educational needs, and sometimes to needs disappearance. Satisfying the needs of adults in terms of knowledge and skills creates conditions for their further development. Needs belong in the process of education to stimulate and implement in the conditions in which there are social and cultural stimulators that favor their arousal.

**Figure 2: Educational needs of adults**



### 1.2.1. Individualized educational programs

Individualized educational programs should be tailored to the individual needs and expectations of adults, both in terms of content, strategies, methods, space and supporting tools. Adult education is "following" a person or a group of learners, which can be achieved taking into account the needs and expectations.

### 1.2.2. The need for constant intellectual activity

Another need is to plan education so that the time between classes is intellectually active. The point is that the intellectual work started during the classes should be continued outside of them, when the adult has time for calm reflection. Then there is a "working through" what happened during the class. So it should be determined in advance whether this overwork is to occur right after leaving the training room. For this purpose, it is necessary to leave partially open problems, so that the participant, thinking about their solution, prepares for the next classes and builds motivation to learn.

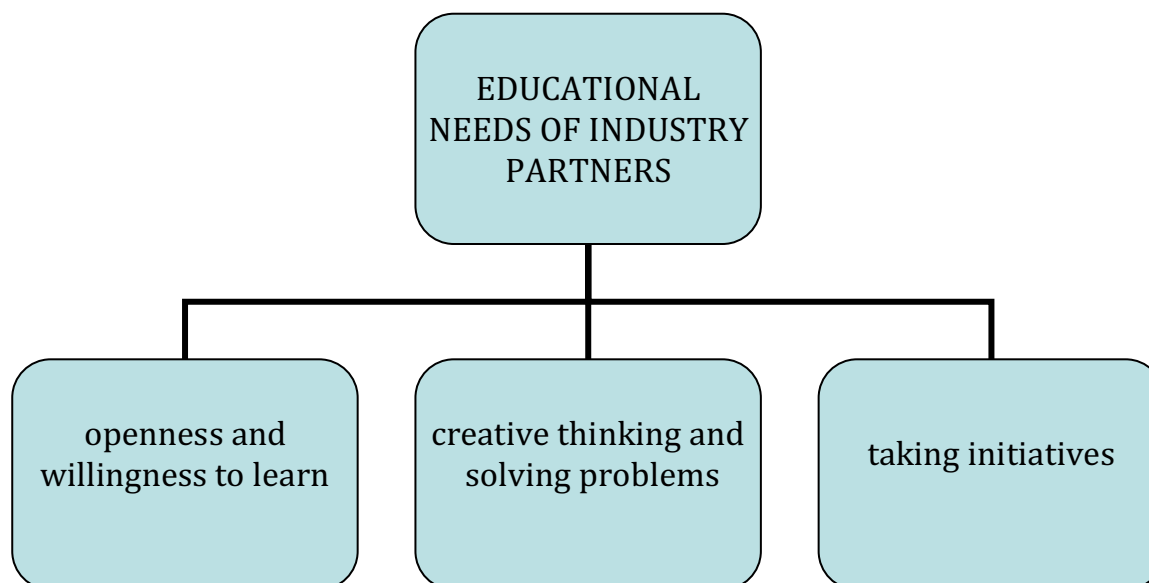
### 1.2.3. The need of control and evaluation of the learning process and its outcomes

Adults need to know what they've learned. In order to meet this need, systematic control and evaluation of the adult education process is necessary. It is important that during the evaluation there is a clear separation between the assessment of the person and the assessment of the activity and the achieved results. The level of task performance and progress (change) in the manner of their performance should also be analyzed separately. The element of control and assessment is an essential part of the education process, constituting its final stage.

## 1.3 Educational needs of industry partners

In the face of dynamic socio-economic changes, an increasingly important factor to facilitate entry into the labor market are practical skills. Thanks to them, new employees can smoothly start performing their duties professional. Both learning the profession with employers, internships and apprenticeships in enterprises, as well as and other forms of cooperation between vocational education institutions and entrepreneurs, help young people people to gain experience, improve their professional qualifications and obtain important ones soft skills. This is evidenced by the results of research carried out in countries where education vocational education is conducted within the framework of dual education systems, among others in Austria, Germany and Switzerland (Hippach-Schneider, Huismann, 2019; Bliem, 2016; Trisher, 2016).

**Figure 3: Educational needs of industry partners**



### 1.3.1. Openness and willingness to learn

Adults are a diverse group in terms of openness and readiness to learn. This is influenced by their previous experience, skills and previous education. It is this diversity that is the main challenge of adult education. Therefore, adult education should prepare and support participants in solving intellectual problems. It should provide knowledge about the changes that a person undergoes in adulthood and shape the awareness that for education to be effective, the same teaching strategies and learning models cannot be used in relation to children and adults.

### 1.3.2. Creative thinking and solving problems

The constantly changing socio-economic environment and growing competitiveness set the framework for the functioning of modern enterprises. On the one hand, they are a chance for business success, but on the other hand, they generate difficulties in development. In this situation, they become necessary tools that respond to the problems encountered and means of creating innovative solutions that enable enterprises progress. Enterprises must not only face current difficulties, competition on the market of services provided and manufactured goods, but also bear responsibility for decisions and consequences of their actions. Traditional methods of solving organizational problems based on the analysis of numerical data do not always bring the intended results. Great potential is therefore seen in creative thinking, both

at the level of individual employees and entire teams. Creative thinking gives you a chance to gain an advantage on the market and allows you to find non-standard solutions problems and turn failure into success.

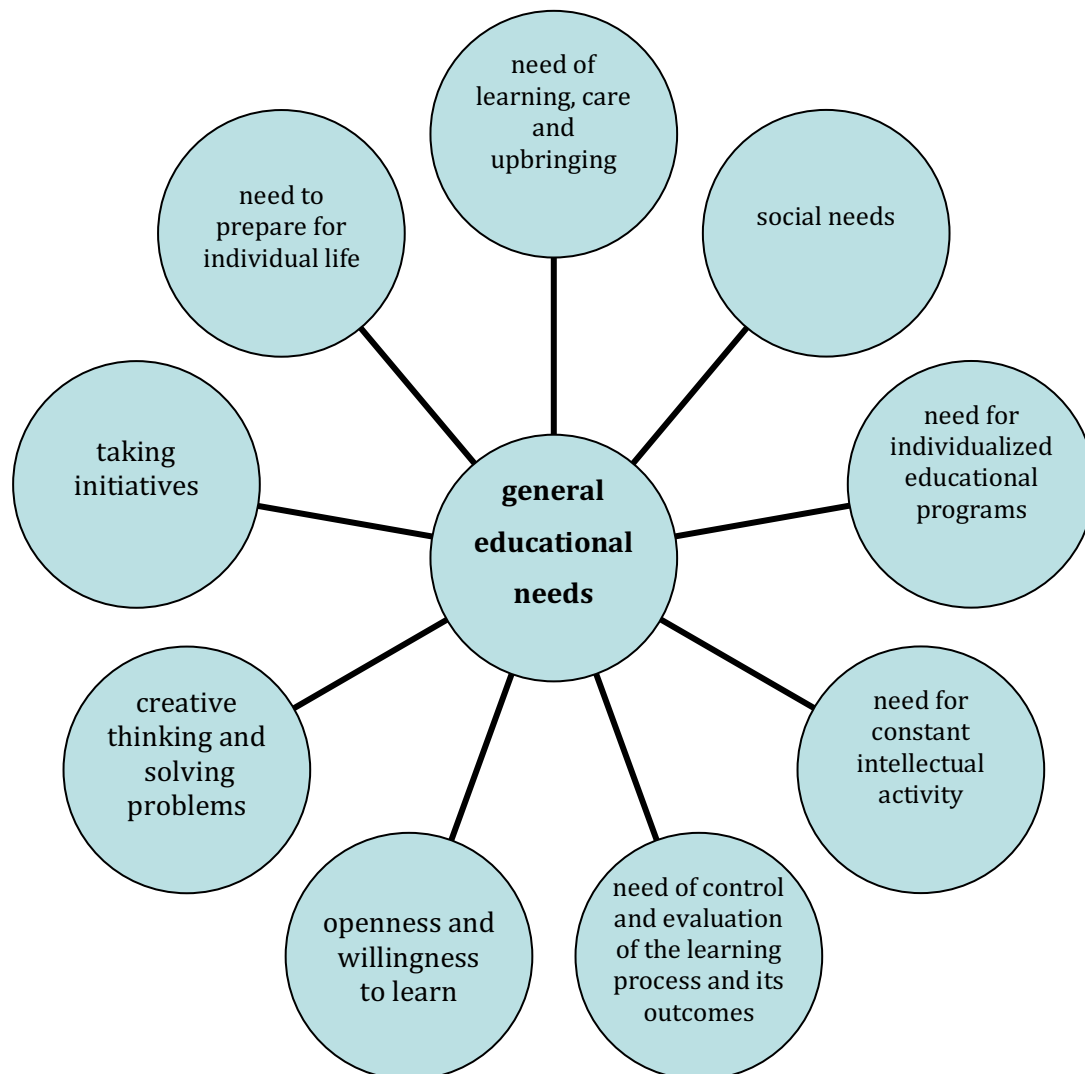
### 1.3.3. Taking initiatives

Human innovation is the ability to perceive new issues as development opportunities, learning from mistakes, turning problems into successes, readiness to accept and implement changes. Being innovative and innovation as a life attitude is not an easy task (Goerdel 2006). This is because although innovations are popularized in the media (specialized and popular science), people are still reluctant to accept what is new because it requires a change in habits and intellectual effort. Schools also have a problem with the dissemination of students innovation, because formal education is still focused on the assimilation of knowledge (memorizing). Perhaps that is why innovation is one of the three main needs and expectations of employers, business institutions and broadly understood business.

### 1.4. General model of educational needs

The results of previous research prove that the educational needs of children, youth, adults and industry are constantly changing. They are conditioned by self-esteem, expectations, previous life experiences (including educational ones), current life, social and economic situation as well as goals pursued by a person. Identifying and meeting one's own educational needs is of particular importance in a knowledge-based society where knowledge is an essential component of social capital and knowledge sharing is an important condition for the development of man, society and economy (Hargreaves, 2003).

**Figure 4: General model of educational needs**



Thus, it is possible to identify the general educational needs of both children, youth, adults and business partners, but in practice it is very difficult to comply with them. Therefore, it is better to design the offer and educational activities for a specific group of learners, taking into account their individual educational needs.

### 1.5. Learner needs and industry partner needs – literature review



The literature agrees that universities and industry needs are crucial for preparing students for employment (Delahaye 2008; Konrad 2018). Moreover, partnerships between academia and industry help students bridge the gap between what they learn in school and what they need in the workplace. Working on real-world problems enables students to apply theoretical knowledge in a practical setting and develop desired professional skills (Konrad 2018).

The needs of learners and industry were a subject of many analyses. They are treated in terms of partnerships. Collis (2008) argues that for universities to build successful partnerships with industry, their online portals must be easy to find and facilitate efficient communication. The implementation of such portals, however, can face delays integrating with university systems. Ferns (2016) suggests that to meet industry needs, universities must provide resources on how industry can optimally participate in work-integrated learning. The research found that industry seeks resources on the mode, topics, and types that would enhance their engagement. Delahaye (2008) examines a case study of a university-NGO partnership and finds that such partnerships require time, patience, and planning to transfer knowledge using rich communication. In the study it is recommended seven principles for industry to form learning partnerships, including building long-term relationships, scouting partners, gaining familiarity, and planning the learning environment. Konrad (2018) provides suggestions for engaging industry in the classroom, including framing projects to develop students' skills, managing data, and communication. The author finds that students and industry rate such partnerships highly. Fitzgerald (2021) explores industry-university partnerships in developing short courses and micro-credentials. The author argues that such partnerships can better serve learners' workplace and lifelong learning needs. Chopra (2017) claims that establishing college-industry partnerships is vital for student success in engineering and technology. Instructors must build relationships so students can learn through site visits, projects, and guest lectures. Instructors play an important role in establishing such challenging partnerships. Pai (1997) stresses that college-industry partnerships can enhance student learning by teaching applied concepts and addressing real-world challenges. They discuss a partnership between Alcoa and North Carolina State University that achieved these objectives. Finally, Estriyanto (2021) describes a teaching-industry partnership program between a vocational high school and industry. They find that successful programs require close relationships to share knowledge, skills, equipment, and funding. While the program aligned with preparing competent graduates, it did not yet meet the industry's labor demand.

In summary, the papers suggest that agreeing university-industry needs require effort and planning but can benefit both learners and industry by enhancing learning, developing skills, and addressing real-world needs. Successful partnerships are built on close relationships, shared resources, communication, and aligning with industry needs. Universities and industry can build sustainable partnerships that benefit learners and employers by following key principles around building long-term, collaborative relationships, aligning

objectives, and actively engaging partners. Challenges remain in fully achieving a demand-driven model. Therefore, the presented model from section 1.4 is based on mainstream analyses and concerns basic categories. This solution provides a universal framework for further studies on the topic.

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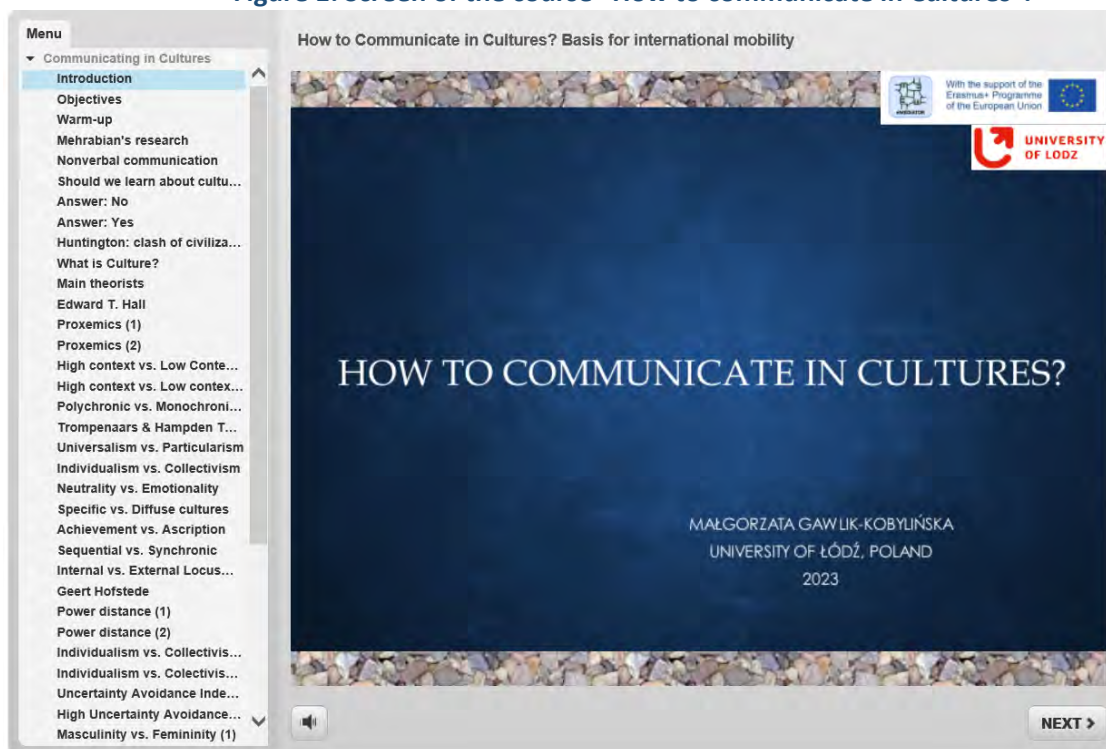
## 2. A6.1. Extra. 7. Development of Interactive training material for Training Event (UL)

Interactive training materials include:

- 1) How to Communicate in Cultures? Basis for international mobility
- 2) Savoir Vivre in a Virtual Learning Environment
- 3) E-Mediator Pedagogical Model
- 4) Digital Learning in The Knowledge Society

- 1) “The course How to Communicate in Cultures? Basis for international mobility” was prepared in Articulate Storyline software. It provides a theoretical framework for understanding cultural differences. The theoretical part ends with a short quiz of different types of questions, such as true/false, match the items.

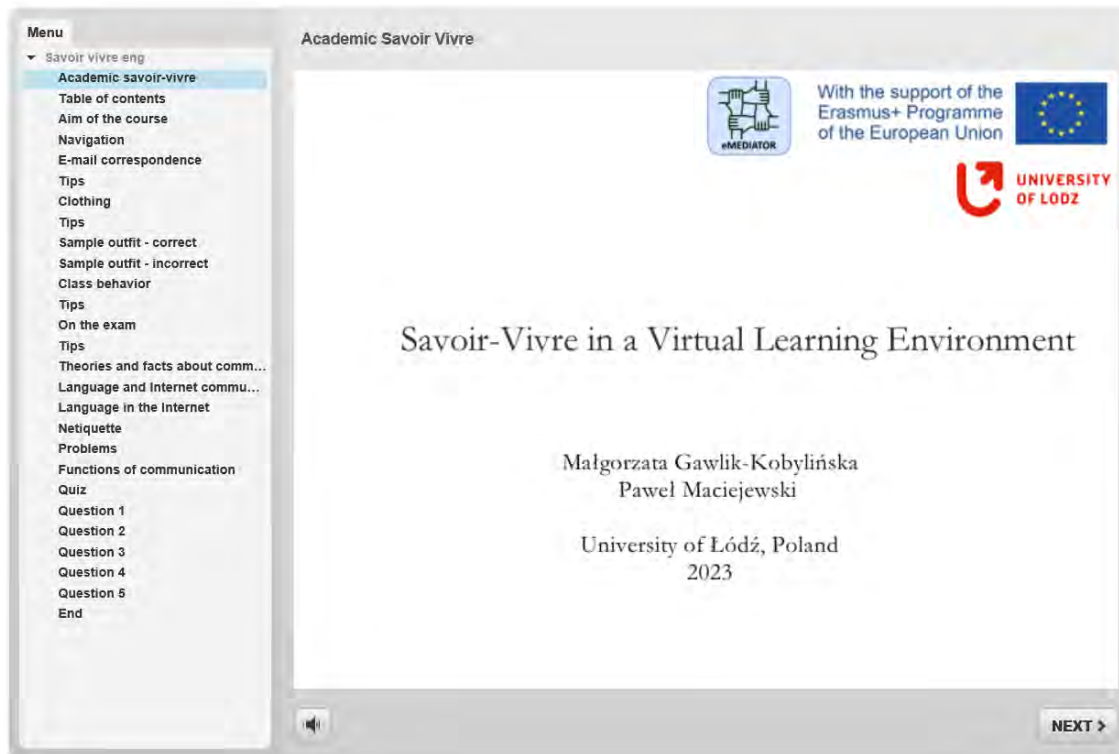
Figure 1: Screen of the course “How to communicate in Cultures”.



- 2) Savoir Vivre in Virtual Learning Environment was prepared in Articulate Storyline. It contains useful information and tips concerning a cultural behaviour in a virtual learning environment. Described

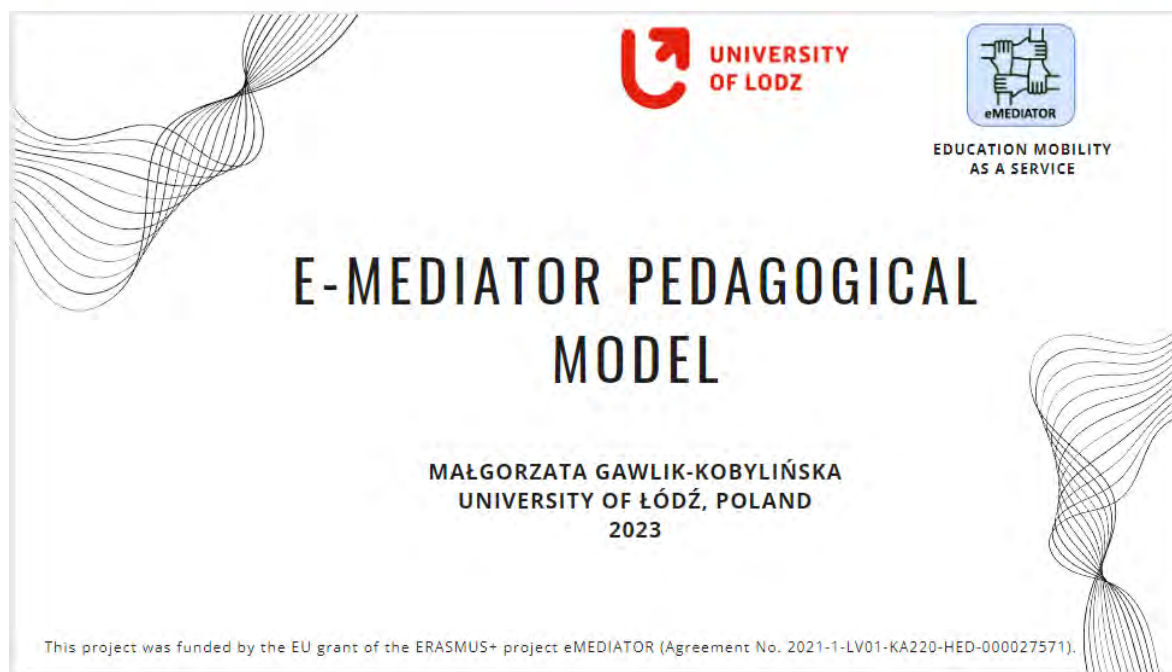
situations concern an educational context. The theoretical part ends with a short quiz of different types of questions, such as true/false, match the items.

**Figure 2: Screen of the course “Savoir Vivre in a Virtual Learning Environment”.**



- 3) E-Mediator Pedagogical Model was designed in Canva software. It contains information on how the model was built and what are its crucial components. The theoretical part ends with a short quiz of different types of questions, such as true/false, match the items.

**Figure 3: Screen of the course “e-Mediator Pedagogical Model”.**



The courses were prepared according to one of the general instructional design model – ADDIE (Analysis, Design, Development, Implementation, and Evaluation). This model provides a conceptual framework for systematically developing effective instructional materials and courses. Multiple studies found the ADDIE model useful for designing instruction. When implemented procedurally, it provides structured guidance for developing instructional materials and courses. The model has been applied to design instruction for various subjects, including e-courses, library instruction, design and technology, structural mechanics, and religious education.

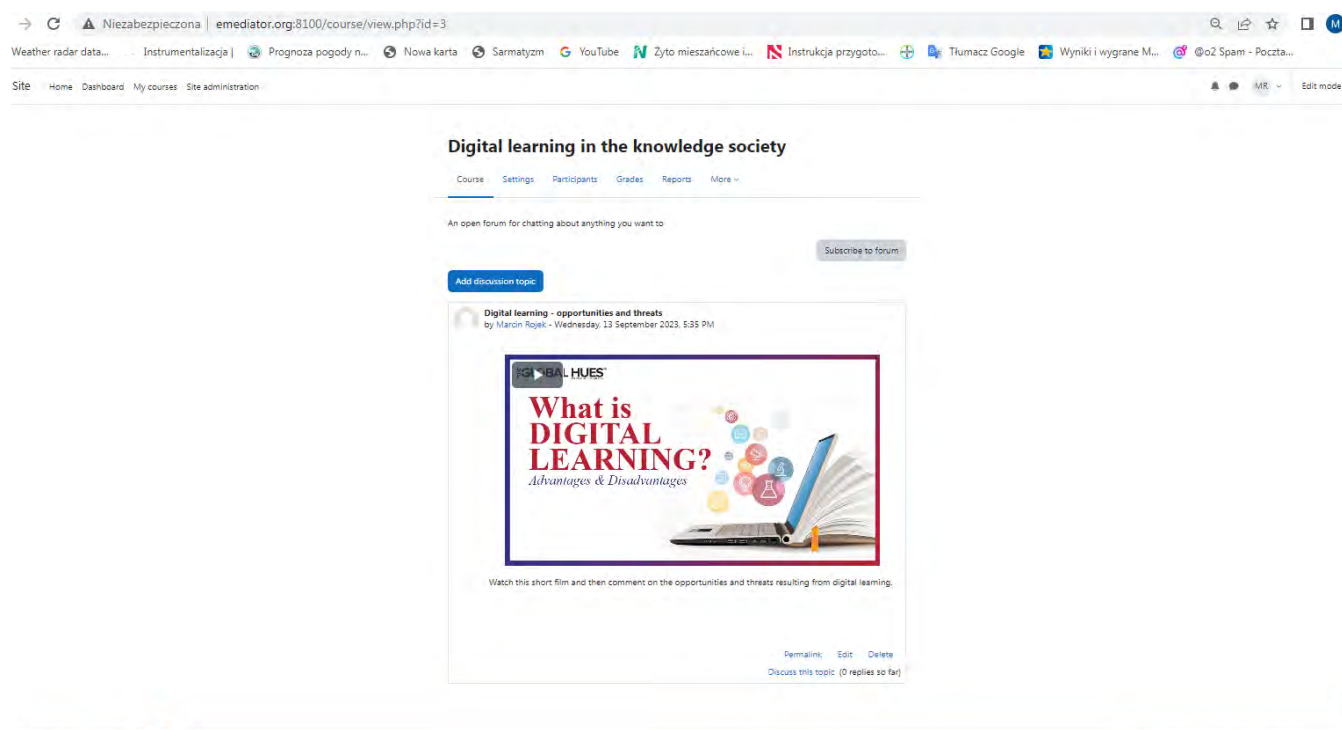
It should be noted that it is possible to create the courses in different formats. The choice of different tools (Articulate and Canva) may encourage future course designers and teachers to prepare the content in their favourite tools (however, they should be compliant with e-Mediator system).

#### 4. Digital Learning In The Knowledge Society

This course is devoted to digital learning in the knowledge society. It contains information about what digital learning is, how it takes place, its conditions and benefits in the knowledge society. The aim of the course is to develop the user's critical thinking and awareness of educational opportunities and threats resulting from the use of modern communication technologies and digital tools.



Figure 4: Screen of the course “Digital Learning In The Knowledge Society”.



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## 3 . A6.2 6. Development of model of certification of learning outcomes on the portal (TSI)

In the rapidly evolving landscape of education, the emergence of digital platforms and innovative approaches has reshaped the way learners access, engage with, and validate their learning experiences. The concept of "Mobile Education as a Service" (EaaS) has introduced a paradigm shift in education delivery, emphasizing accessibility, flexibility, and personalized learning. One pivotal aspect of this transformative model

is the certification of learning outcomes, a process that not only acknowledges learners' achievements but also reflects the dynamic nature of modern education.

This report delves into the intricacies of the model of certification of learning outcomes on the EaaS portal, exploring its significance, components, benefits, and implications for the future of education. As digital credentials gain prominence as a tangible representation of skills and competencies, understanding the mechanics behind their issuance within the EaaS ecosystem becomes essential for educators, learners, employers, and policymakers alike. This report aims to shed light on the novel aspects of this certification model, contrasting it with traditional education paradigms, and ultimately providing insights into how it is revolutionizing the educational landscape in the digital age.

By delving into the multifaceted aspects of the certification of learning outcomes on the EaaS portal, this report aims to equip readers with a comprehensive understanding of its role in shaping the future of education, fostering lifelong learning, and empowering learners to thrive in an interconnected world.

## 2.1 State the Objective of the Report in Exploring the Model of Certification of Learning Outcomes on the EaaS Portal

The primary objective of this report is to comprehensively explore and analyze the model of certification of learning outcomes within the context of the EaaS portal. As digital education continues to reshape the learning landscape, the certification of learning outcomes plays a pivotal role in validating learners' achievements and skills acquired through online learning platforms. This section outlines the specific goals and intentions of this report.

1. **Understanding the Certification Process.** The report aims to provide a clear understanding of how the EaaS portal certifies learning outcomes. It will delve into the mechanisms, processes, and criteria that underlie the issuance of digital badges, certificates, or other forms of credentials to learners who successfully complete courses or programs.
2. **Exploring Components and Methodologies.** The report will examine the components and methodologies involved in the certification process. This includes an exploration of how assessments, evaluations, and competencies mapping contribute to learners earning digital credentials that reflect their acquired knowledge and skills.
3. **Highlighting the Benefits of Digital Credentials.** Another objective of the report is to emphasize the benefits of digital credentials in the EaaS ecosystem. This involves discussing how digital credentials enhance portability, shareability, transparency, and verification, thus adding value to learners' professional profiles and employability.

4. Comparing with Traditional Certification Models. The report will compare and contrast the model of certification of learning outcomes on the EaaS portal with traditional certification models, such as degrees issued by brick-and-mortar universities. By doing so, the report aims to showcase the distinct advantages and considerations of both approaches.
5. Analyzing Implications for Learners and Stakeholders. The report seeks to analyze the implications of digital credentials for learners, education providers, employers, and other stakeholders. This includes understanding how digital credentials impact employment opportunities, skills validation, and education delivery.
6. Examining Future Trends and Directions. As digital education continues to evolve, the report will explore future trends and directions in the realm of certification of learning outcomes. It will consider how these trends might shape the education landscape, workforce development, and professional recognition.
7. Providing Insights for Policymakers and Educators. The report aims to provide insights that can inform policymakers and educators about the role of digital credentials in modern education. It will consider how digital credentials align with the changing needs of learners and the demands of a rapidly evolving job market.
8. Empowering Decision-Makers. Ultimately, the objective of this report is to empower decision-makers within the education ecosystem to make informed choices about the implementation and recognition of digital credentials. By offering a comprehensive overview, the report equips stakeholders with the knowledge needed to navigate the changing landscape of education and certification.

## 2.2 Evolving Landscape of Education and the Shift towards Digital and Online Learning Platforms

In recent years, the landscape of education has undergone a profound transformation, driven by technological advancements, changing learner preferences, and the need for more accessible and flexible learning opportunities. The traditional classroom-centric model of education has evolved into a diverse ecosystem that embraces digital and online learning platforms. This section explores the factors that have contributed to this evolving landscape and the significant shift towards digital education.

1. Technological Advancements. Rapid advancements in technology have reshaped the way information is accessed, shared, and consumed. The proliferation of high-speed internet, mobile devices, and digital tools has enabled educators and learners to connect and engage in ways that were previously

unimaginable. As a result, the traditional confines of physical classrooms have expanded to include virtual spaces where education can be accessed from anywhere, anytime.

2. **Globalization and Connectivity.** The digital age has blurred geographical boundaries, facilitating global connectivity and collaboration. Learners now have access to a wealth of educational resources, courses, and experts from around the world. Online platforms have democratized education, making high-quality learning experiences accessible to diverse audiences regardless of their location.
3. **Changing Learner Demographics and Preferences.** Learners today, often referred to as "digital natives," are accustomed to technology in all aspects of their lives. They seek learning experiences that align with their digital lifestyles, preferences for on-demand access, and desire for self-paced learning. Online learning platforms cater to these preferences by offering flexible and personalized learning journeys.
4. **Lifelong Learning and Skills Enhancement.** In a rapidly changing job market, the need for continuous skill development and upskilling has become paramount. Online learning platforms provide an avenue for individuals to acquire new skills, update their knowledge, and remain relevant in their careers. This shift from traditional episodic education to lifelong learning aligns with the demands of the modern workforce.
5. **Cost and Accessibility.** Traditional higher education institutions often come with substantial costs, including tuition fees, accommodation, and transportation expenses. Online learning platforms offer more affordable alternatives, reducing financial barriers and making education accessible to a broader audience, including those who may not have pursued education due to financial constraints.
6. **Personalization and Adaptive Learning.** Digital platforms leverage data analytics and machine learning algorithms to deliver personalized learning experiences. Learners can engage with content that matches their skill level, learning pace, and preferences, enhancing engagement and knowledge retention.
7. **Blended Learning Models.** The shift towards digital education has given rise to blended learning models that combine traditional classroom instruction with online resources. This hybrid approach offers the benefits of both face-to-face interaction and digital flexibility, catering to diverse learning styles.
8. **Emergence of EaaS Platforms.** Within this evolving landscape, the concept of "Mobile Education as a Service" (EaaS) has gained prominence. EaaS platforms leverage mobile technology and cloud-based solutions to provide flexible, accessible, and on-demand learning opportunities to learners, thereby shaping the future of education.

The evolving landscape of education is characterized by the widespread adoption of digital and online learning platforms. These platforms cater to changing learner preferences, foster global connectivity, and enable continuous skill development. The emergence of EaaS platforms further underscores the transformative



potential of digital education, offering learners a dynamic and accessible pathway to knowledge acquisition and skills enhancement.

## 2.3 Importance of Certification and Credentialing in Validating Learning Achievements

Certification and credentialing serve as crucial mechanisms for validating learning achievements in the rapidly evolving landscape of education. In an era where traditional educational boundaries are expanding and digital platforms are reshaping the learning experience, the need to accurately recognize and verify the skills and knowledge acquired by learners has become more significant than ever. This section provides context for understanding the vital role that certification and credentialing play in validating learning achievements within the Education as a Service (EaaS) framework.

1. **Validation of Learning.** As education diversifies and learning opportunities span across various platforms, certification and credentialing validate the authenticity of the knowledge and skills learners acquire. They provide evidence that learners have successfully completed a course, program, or training and have met predetermined standards of achievement.
2. **Credibility and Trust.** Certification and credentials add credibility to the learning outcomes achieved by learners. They signal to employers, educational institutions, and other stakeholders that the learner's knowledge and skills have been assessed and verified by reputable education providers. This builds trust in the value of the education delivered through digital platforms.
3. **Recognition and Employability.** In a competitive job market, certifications and credentials distinguish individuals by showcasing their specialized skills and competencies. Digital credentials earned from the EaaS portal validate a learner's ability to apply knowledge to real-world scenarios, making them more attractive candidates for employment opportunities.
4. **Alignment with Industry Needs.** Many certification programs and digital credentials are designed in collaboration with industry experts and professionals. This alignment ensures that learners' skills match the specific demands of the job market and industries, enhancing their readiness to contribute effectively to the workforce.
5. **Global Recognition.** Digital credentials issued on EaaS platforms often adhere to open standards, making them globally recognized and compatible with various educational and professional systems. This recognition facilitates the seamless transfer of skills and achievements across international boundaries.
6. **Lifelong Learning and Skill Enhancement.** In the context of lifelong learning, certifications and credentials encourage learners to engage in continuous skill enhancement. They provide a tangible

incentive for learners to pursue additional courses, micro-credentials, and training opportunities, contributing to ongoing personal and professional development.

7. **Verifiability and Transparency.** Digital credentials include metadata that detail the specific competencies achieved, assessment methods, and issuing institution. This level of transparency allows employers, educational institutions, and other stakeholders to verify the authenticity of the credential and the skills it represents.
8. **Personalized Learning Pathways.** Certifications and credentials also enable learners to create personalized learning pathways by stacking multiple credentials that align with their career goals. This flexibility empowers learners to tailor their educational journeys to their specific interests and needs.
9. **Institutional Quality Assurance.** For education providers, certification serves as a quality assurance mechanism. Earning a reputation for delivering credible and valuable certifications contributes to the credibility and trustworthiness of the EaaS platform.

The importance of certification and credentialing within the EaaS framework extends beyond validation; it encompasses credibility, recognition, and employability. As education embraces digital platforms and diversified learning opportunities, certifications play a pivotal role in establishing a standardized and recognized way of evaluating and verifying learners' achievements. This context underscores the value of the certification model within the EaaS ecosystem, fostering a culture of continuous learning and skills enhancement.

## 2.4 Concept of Certification of Learning Outcomes and its Role in Recognizing Learner Achievements

Certification of learning outcomes is a pivotal concept that bridges the gap between education and validation in the digital era. It entails the formal recognition and verification of the knowledge, skills, and competencies that learners acquire through educational experiences. This section delves into the core definition of certification of learning outcomes and elucidates its essential role in acknowledging and validating learner achievements within the Education as a Service (EaaS) ecosystem.

### *Definition of Certification of Learning Outcomes*

Certification of learning outcomes refers to the process through which learners' achievements, encompassing knowledge mastery and skill acquisition, are officially recognized and documented. It involves the issuance of

digital badges, certificates, or other forms of credentials that serve as tangible evidence of the skills learners have acquired upon successful completion of a course, program, or training module.

### *Role of Certification in Recognizing Learner Achievements*

The role of certification of learning outcomes is multifaceted, encompassing validation, recognition, and empowerment:

1. **Validation of Learning.** Certification validates the learning journey undertaken by individuals. It affirms that learners have met specific learning objectives, successfully completed assessments, and demonstrated their understanding of course content.
2. **Recognition of Accomplishments.** Digital credentials earned through certification serve as visual representations of learners' accomplishments. They signify the acquisition of specialized knowledge and competencies that contribute to personal and professional growth.
3. **Professional Credibility.** Certification enhances learners' credibility in their chosen fields. It offers assurance to employers, peers, and stakeholders that learners possess the expertise and skills needed to excel in relevant roles.
4. **Employability Enhancement.** Certifications bolster learners' employability by showcasing their qualifications in a standardized and recognizable manner. Employers can quickly gauge the skill set of potential employees, making informed hiring decisions.
5. **Portability and Shareability.** Digital credentials earned through certification are portable across platforms and institutions. Learners can share their achievements on social media, professional networking sites, and online résumés, amplifying their visibility.
6. **Lifelong Learning Motivation.** Certification fosters a culture of lifelong learning. As learners witness the tangible benefits of certification, they are more inclined to pursue additional courses and credentials to further enhance their knowledge and skills.
7. **Contributing to Continuous Professional Development.** Certifications align with the concept of continuous professional development. They encourage learners to stay updated with industry trends and advancements, ensuring their expertise remains relevant over time.
8. **Standardization and Quality Assurance.** Certification ensures a level of standardization and quality assurance across educational offerings. It verifies that courses and programs meet predefined learning objectives and provide valuable outcomes to learners.
9. **Recognition of Micro-Credentials.** In the digital era, micro-credentials, which focus on specific skills or topics, have gained prominence. Certification plays a pivotal role in formally acknowledging the attainment of these micro-credentials.

The concept of certification of learning outcomes bridges the gap between learning and recognition. It encapsulates the learner's journey, skills, and achievements in a format that is universally recognizable, shareable, and validated. Within the EaaS framework, certification empowers learners to excel in a dynamic learning landscape while offering education providers a means to validate and showcase the efficacy of their offerings.

## 2.5 The difference between traditional degrees and digital credentials

The model of certification of learning outcomes on the Education as a Service (EaaS) portal and the traditional model of university certification have several key differences, mainly related to their delivery, accessibility, structure, recognition, and flexibility. Here are some of the main differences between the two models:

### 1. Delivery and Accessibility.

- EaaS Portal. The EaaS portal offers digital badges and certificates that are accessible online, allowing learners to showcase their achievements virtually. The credentials are often in digital format, making them easily shareable across online platforms.
- Traditional University. Traditional university certifications typically involve physical certificates or diplomas that are awarded to learners upon completing their degree programs. These physical credentials may need to be presented in person or through physical mail.

### 2. Structure and Learning Opportunities.

- EaaS Portal. The EaaS portal offers a diverse range of short courses, micro-credentials, and skill-specific programs. Learners can choose from a variety of learning opportunities that align with their interests and needs.
- Traditional University. Traditional universities primarily offer degree programs that follow a structured curriculum. Learners commit to longer-term academic pursuits that cover a broader range of subjects.

### 3. Recognition and Portability.

- EaaS Portal. Digital credentials from the EaaS portal are designed to be easily shareable and verifiable online. They can be displayed on social media, personal websites, or résumés, and are often linked to metadata that provide details about the competencies acquired.

- Traditional University. Traditional university degrees are recognized globally and carry a certain level of prestige. However, they might require more formal verification processes, and some employers or institutions may not be familiar with degrees from certain universities.
4. Flexibility and Customization.
- EaaS Portal. EaaS platforms offer flexibility in terms of course selection and completion timelines. Learners can often choose courses that align with their immediate goals and skills enhancement, allowing for more personalized learning journeys.
  - Traditional University. Traditional universities often have fixed academic calendars and program structures. Learners typically follow a predetermined curriculum with less flexibility to customize their learning paths.
5. Time and Duration:
- EaaS Portal. Courses on EaaS platforms are often designed for shorter durations, ranging from a few weeks to a few months. This allows learners to acquire specific skills quickly and efficiently.
  - Traditional University. Traditional degree programs are longer in duration, usually spanning several years. Learners commit to a more extended period of study to complete their degrees.
6. Cost and Affordability.
- EaaS Portal. EaaS platforms often offer courses at a lower cost compared to traditional university degree programs. This makes skill acquisition and continuous learning more accessible to a wider range of learners.
  - Traditional University. Traditional university degrees, especially those from reputable institutions, can be more expensive due to the comprehensive nature of degree programs.
7. Entry Requirements.
- EaaS Portal. Many EaaS courses have minimal entry requirements, making them accessible to a broad audience. Learners can often start courses without the need for extensive prerequisites.
  - Traditional University. Traditional university degree programs usually have specific entry requirements, including standardized test scores, transcripts, and sometimes interviews or recommendations.

The model of certification of learning outcomes on the EaaS portal and the traditional university model offer distinct approaches to education and certification. The EaaS model emphasizes flexibility, short-term skill acquisition, and digital credentials, while the traditional university model focuses on comprehensive degree programs, formal degrees, and academic prestige. Both models cater to different learner needs and can complement each other in providing diverse educational opportunities.



## 2.6 Concept of Certification of Learning Outcomes

Certification of learning outcomes represents a transformative shift in education, aligning with the changing dynamics of digital learning and the demands of the modern workforce. This section provides an in-depth exploration of the concept of certification of learning outcomes, elucidating its significance, components, and implications within the Education as a Service (EaaS) framework.

### *Significance of Certification of Learning Outcomes*

Certification of learning outcomes serves as a cornerstone in validating the skills and knowledge learners acquire through digital education. It moves beyond traditional degrees and transcripts to offer tangible proof of a learner's mastery of specific competencies. This approach holds profound implications for learners, employers, and education providers:

1. **Learners.** For learners, certification provides a structured pathway to skill development and professional advancement. It fosters motivation, as the attainment of digital credentials signifies meaningful progress and recognition of achievements.
2. **Employers.** Certification offers employers a reliable and standardized way to assess a candidate's skills and qualifications. It streamlines the recruitment process by providing verifiable evidence of a candidate's readiness to contribute to the workplace.
3. **Education Providers.** EaaS platforms benefit from the certification model by enhancing the perceived value of their offerings. By issuing digital badges and certificates, education providers demonstrate their commitment to quality education that aligns with industry needs.

### *Components of Certification of Learning Outcomes*

The certification of learning outcomes encompasses several key components that contribute to its effectiveness and credibility:

1. **Assessment and Evaluation.** Certification relies on robust assessment methods to evaluate learners' understanding and application of course content. This involves quizzes, assignments, projects, exams, and other evaluative tools.
2. **Competencies Mapping.** Learning outcomes achieved by learners are meticulously mapped to specific competencies. This mapping ensures that digital credentials accurately reflect the skills and knowledge learners have acquired.

3. Digital Badges and Certificates. Upon successful completion of courses or programs, learners are awarded digital badges or certificates. These digital credentials encapsulate metadata that provide comprehensive information about the course, competencies, and assessment methods.
4. Verification and Authenticity. Certification emphasizes the importance of authenticity. Digital credentials are verified using cryptographic technology, preventing unauthorized alterations and ensuring that learners' achievements are credible and trustworthy.
5. Shareability and Accessibility. Digital credentials are designed for easy sharing across various platforms, including social media, professional networks, and personal websites. This feature enhances the visibility of learners' accomplishments.

### *Implications of the Certification Model*

The introduction of the certification model within the EaaS ecosystem brings about far-reaching implications for the future of education and employment:

1. Personalized Learning Pathways. Certification supports personalized learning by allowing learners to choose courses that align with their unique goals, tailoring their educational journey.
2. Global Recognition. Digital credentials transcend geographical boundaries, enabling learners to showcase their achievements to a global audience.
3. Continuous Learning Culture. Certification fosters a culture of continuous learning, motivating learners to pursue further courses and micro-credentials to stay updated with industry advancements.
4. Enhanced Employability. Certified learners are equipped with evidence of specific skills, enhancing their employability and competitiveness in the job market.
5. Quality Assurance. The certification model encourages education providers to maintain high standards, ensuring that the skills and knowledge imparted are relevant and valuable.

The concept of certification of learning outcomes redefines how learning achievements are recognized and verified. It aligns with the principles of EaaS by offering accessible, verifiable, and personalized credentials that validate learners' skills and competencies. By embracing this model, EaaS platforms contribute to shaping a future where education is not only accessible but also intrinsically linked to real-world skills and achievements.

## 2.7 Components of the Certification Model

The certification model within the Education as a Service framework comprises a range of interrelated components that collectively contribute to the issuance, verification, and recognition of digital credentials. This section explores the key components that constitute the certification model, shedding light on their roles, significance, and the seamless process through which they validate learning outcomes.

1. **Assessment and Evaluation.** Assessment and evaluation serve as foundational components of the certification model. Learners engage in various assessment activities, such as quizzes, assignments, projects, and examinations, designed to gauge their understanding and application of course content. These assessments are meticulously crafted to align with specific learning objectives and competencies.
2. **Competencies Mapping.** The process of mapping competencies is pivotal to the certification model. Learning outcomes achieved by learners are mapped to specific competencies, skills, or knowledge areas. This mapping ensures that the digital credentials awarded accurately represent the capabilities that learners have acquired through their educational journey.
3. **Digital Badges and Certificates.** Upon successful completion of assessments and the fulfillment of competency requirements, learners are awarded digital badges or certificates. These digital credentials serve as visual representations of learners' achievements and skills. They include essential information such as the course or program completed, the issuing institution, the competencies mastered, and the assessment methods used.
4. **Verification and Authenticity:** Verification and authenticity are integral aspects of the certification model. Digital credentials are secured using cryptographic technology, ensuring that they cannot be tampered with or forged. This cryptographic security guarantees the authenticity of the credential, enabling employers, educational institutions, and other stakeholders to trust the validity of the achieved learning outcomes.
5. **Metadata and Transparency.** Digital credentials include metadata that provide comprehensive details about the learning experience and outcomes. Metadata can encompass information such as the duration of the course, the learning objectives achieved, the assessment methods used, and even links to relevant learning resources. This transparency enhances the credibility and value of the digital credential.
6. **Shareability and Visibility.** One of the key advantages of digital credentials is their shareability across various online platforms. Learners can proudly showcase their achievements on social media, professional networking sites, personal websites, and online résumés. This shareability enhances the visibility of their accomplishments and contributes to building a strong digital presence.
7. **Credential Portability.** Digital credentials issued within the certification model are designed for portability. They can be easily transferred and shared across different platforms and institutions.



Learners can carry their digital credentials with them as they transition between educational programs or job opportunities, facilitating seamless recognition of their skills.

8. **Lifelong Learning Record.** The certification model contributes to creating a lifelong learning record for each learner. As learners complete multiple courses and earn digital credentials over time, their record reflects the diverse range of competencies they have acquired. This record underscores the value of continuous learning and skills enhancement.
9. **Integration with Skill Demands.** The certification model's components are strategically aligned with the demands of the job market and industries. By mapping competencies to specific skills and knowledge areas, digital credentials offer employers a clear understanding of a candidate's capabilities, ensuring a more precise match between education and employment needs.

The components of the certification model synergize to provide learners with credible, verifiable, and accessible recognition of their learning achievements. By integrating assessment, competencies mapping, digital credentials, verification, and transparency, EaaS platforms create a comprehensive ecosystem that validates and rewards learners' pursuit of knowledge and skills. This model revolutionizes the way educational outcomes are recognized, bridging the gap between education and employability in the digital age.

## 2.8 Digital Credentials and Their Attributes

Digital credentials are at the forefront of transforming the way learning achievements are recognized and communicated in the digital age. These credentials, issued within the Education as a Service (EaaS) ecosystem, offer a dynamic and accessible way to validate learners' skills and competencies. This section delves into the attributes of digital credentials, highlighting their significance, properties, and the ways in which they enhance the transparency and recognition of learners' accomplishments.

1. **Metadata-Rich Information.** Digital credentials are not just static badges; they are enriched with metadata that provide comprehensive information about the credential itself and the learner's achievements. Metadata include details such as the issuing institution, the course or program completed, the competencies mastered, the assessment methods used, and the duration of the learning experience. This metadata-rich format enhances the transparency and credibility of the credential.

2. **Verifiability and Authenticity.** One of the most notable attributes of digital credentials is their verifiability and authenticity. These credentials are secured using cryptographic technology, ensuring that they cannot be tampered with or counterfeited. Employers and other stakeholders can easily verify the authenticity of a digital credential, providing them with confidence in the accuracy of the learner's achievements.
3. **Shareability Across Platforms.** Digital credentials are designed to be easily shared across various online platforms, including social media, professional networking sites, and personal websites. Learners can showcase their achievements to a wide audience, amplifying their visibility and showcasing their skills to potential employers, peers, and mentors.
4. **Portability and Accessibility.** Digital credentials are portable and accessible. Learners can carry their digital credentials with them throughout their educational journey and professional career. This portability ensures that their achievements remain recognized, regardless of changes in educational institutions or job opportunities.
5. **Stackable and Modular.** The modular nature of digital credentials allows learners to stack multiple credentials to create a comprehensive representation of their skills and competencies. This "stackability" allows learners to customize their credentials based on their evolving career goals and learning pathways.
6. **Standardization and Open Standards.** Digital credentials adhere to open standards, ensuring interoperability across different platforms and institutions. This standardization facilitates the seamless transfer of credentials between educational providers, promoting a consistent and recognizable format for validating learning achievements.
7. **Real-Time Updates.** As learners engage in continuous learning, digital credentials can be updated in real-time to reflect their latest accomplishments. This dynamic attribute allows employers and stakeholders to view learners' most current skills and competencies.
8. **Alignment with Industry Needs.** Digital credentials align with industry needs and requirements, ensuring that learners' achievements reflect relevant and up-to-date skills. This alignment enhances the credibility of digital credentials in the eyes of employers and industry professionals.
9. **Paperless and Environmentally Friendly.** Digital credentials contribute to sustainability by reducing the need for physical certificates and documents. This paperless attribute aligns with environmentally friendly practices and supports digital initiatives.

The attributes of digital credentials encompass metadata-rich information, verifiability, shareability, portability, and more. By harnessing these attributes, EaaS platforms create a powerful tool for learners to validate their skills, enhance their employability, and showcase their achievements in a transparent and

accessible manner. Digital credentials epitomize the intersection of technology and education, offering a forward-looking solution for recognizing and communicating learning outcomes in the digital era.

## 2.9 Implementation and Challenges

The implementation of the certification model within the Education as a Service (EaaS) ecosystem brings forth numerous opportunities to enhance the recognition of learning outcomes. However, it also presents a set of challenges that must be addressed to ensure the credibility, effectiveness, and seamless operation of the certification process. This section explores both the implementation strategies and the challenges that may arise during the adoption of the certification model.

### *Implementation Strategies*

1. **Technology Integration.** EaaS platforms need to seamlessly integrate the necessary technology for issuing, storing, and verifying digital credentials. This involves the development of secure databases, cryptographic infrastructure, and user-friendly interfaces for learners and stakeholders.
2. **Competencies Mapping.** Establish a clear process for mapping competencies to learning outcomes. Collaborate with educators, industry experts, and curriculum designers to ensure that competencies accurately reflect the skills needed in the modern workforce.
3. **Assessment Design.** Develop rigorous and well-structured assessment methods that align with learning objectives. This includes creating diverse assessment types that effectively evaluate learners' understanding and application of course content.
4. **Credential Design.** Design visually appealing digital badges and certificates that effectively communicate learners' achievements. Ensure that metadata are accurately embedded to provide comprehensive information about the credential.
5. **Verification Mechanism.** Implement a robust verification mechanism that allows employers, educational institutions, and other stakeholders to easily verify the authenticity of digital credentials. Utilize cryptographic technology to prevent tampering or forgery.
6. **User Training.** Provide training and resources to learners on how to access, share, and manage their digital credentials. Similarly, educate employers and stakeholders on the process of verifying and understanding digital credentials.

### *Challenges*

1. **Standardization.** Ensuring a consistent standard for digital credentials across different platforms and institutions can be challenging. Establishing and adhering to open standards becomes crucial for interoperability.
2. **Data Security.** Safeguarding sensitive learner data and ensuring the security of digital credentials are paramount. Robust cybersecurity measures must be in place to prevent unauthorized access or breaches.
3. **Credibility and Recognition.** Convincing employers and stakeholders of the credibility and value of digital credentials may require a shift in mindset. Building recognition for digital credentials as legitimate indicators of skills can take time.
4. **Fraud Prevention.** Preventing the unauthorized issuance or alteration of digital credentials is a challenge. Cryptographic measures must be effective enough to prevent fraudulent activity.
5. **Credential Misuse.** There is a possibility that learners may misuse digital credentials, misrepresenting their achievements. Establish guidelines for ethical use and consequences for misuse.
6. **Learner Privacy.** Collecting and managing learner data for the issuance of digital credentials necessitates a focus on data privacy and compliance with regulations such as GDPR.
7. **Institutional Collaboration.** Collaborating with multiple institutions, educators, and industry partners to develop relevant competencies and assessments requires effective coordination.
8. **Technological Infrastructure.** Building and maintaining the technological infrastructure for issuing and verifying digital credentials requires ongoing investment and maintenance.
9. **Resistance to Change.** Traditional models of education and credentialing may face resistance to change from stakeholders who are accustomed to traditional methods of validation.

The implementation of the certification model in EaaS platforms holds immense promise for transforming how learning outcomes are recognized. However, it also demands careful consideration of technological, organizational, and ethical challenges. By strategizing effectively and proactively addressing these challenges, EaaS platforms can realize the full potential of the certification model in enhancing the credibility and recognition of learners' achievements.

## 2.10 Impact and Future Implications

The adoption of the certification model within the Education as a Service (EaaS) ecosystem has far-reaching implications that extend beyond immediate recognition. The model's impact touches upon learners,

education providers, employers, and the education landscape as a whole. This section delves into the profound impact of the certification model and outlines its future implications for education, employability, and lifelong learning.

### *Impact on Learners*

1. **Empowerment.** The certification model empowers learners to take ownership of their learning journey. Learners can proactively choose courses that align with their interests, stack credentials to showcase a diverse skill set, and continually update their digital credentials to reflect ongoing learning.
2. **Employability.** Digital credentials amplify learners' employability by providing concrete evidence of their skills and achievements. Employers can quickly assess candidates' qualifications, making hiring decisions more informed and efficient.
3. **Lifelong Learning.** The certification model encourages a culture of lifelong learning. Learners are motivated to pursue continuous skill development, staying relevant in a rapidly changing job market.
4. **Professional Growth.** Learners can strategically choose courses that facilitate their professional growth. The certification model aligns with learners' career aspirations and enables them to make informed decisions about their educational pathways.

### *Impact on Education Providers*

1. **Quality Assurance.** The certification model reinforces education providers' commitment to quality education. Providers are incentivized to offer courses that meet industry demands, ensuring learners' skills align with real-world requirements.
2. **Innovation.** EaaS platforms are driven to innovate by offering courses that impart practical skills and relevant competencies. This innovation enriches the learning experience and helps education providers stand out in a competitive landscape.
3. **Collaboration.** The model encourages collaboration between education providers, industry experts, and employers. This collaboration ensures that course content remains relevant and prepares learners for the demands of the workforce.

### *Impact on Employers*

1. **Efficient Hiring.** Digital credentials simplify the hiring process. Employers can quickly assess candidates' skills based on verifiable and standardized digital credentials, leading to more efficient hiring decisions.



2. Customized Skill Matching. Employers can match job requirements with specific competencies indicated in digital credentials. This customized matching leads to more accurate and effective talent acquisition.
3. Upskilling and Reskilling. The certification model supports upskilling and reskilling efforts within organizations. Employers can identify skills gaps and provide targeted training based on employees' digital credentials.

### *Future Implications*

1. Global Recognition. The certification model could lead to a global recognition framework for learning achievements. A standardized approach to digital credentials could transcend geographical boundaries, promoting a common understanding of skills.
2. Credential Portfolios. Learners may develop comprehensive digital credential portfolios that provide a holistic view of their capabilities. These portfolios could serve as dynamic résumés that evolve with ongoing learning.
3. Micro-Credentials. The model may pave the way for a broader acceptance of micro-credentials. Learners can earn micro-credentials for specific skills, creating a more granular representation of their competencies.
4. Blockchain Integration. The integration of blockchain technology could further enhance the security and authenticity of digital credentials, strengthening trust among stakeholders.
5. Recognition by Regulatory Bodies. Regulatory bodies and accreditation organizations might recognize digital credentials as valid indicators of learning outcomes, further elevating their importance.
6. Shift in Hiring Paradigm. Employers may prioritize digital credentials as key hiring criteria, valuing practical skills and competencies over traditional degrees.

The impact of the certification model is transformative, redefining the way learning outcomes are recognized, valued, and communicated. The model's future implications hold promise for a more dynamic and transparent education landscape, where skills are validated through verifiable and relevant digital credentials. As EaaS platforms continue to evolve, the certification model stands as a driving force that connects education, employability, and lifelong learning in the digital age.

## 2.11 Conclusion

The certification of learning outcomes within the context of the Education as a Service (EaaS) framework marks a pivotal step toward transforming how learning achievements are recognized and validated. This model addresses the evolving needs of learners, employers, and education providers in the digital age. The journey through the various sections of this report has illuminated the significance, components, challenges, and future implications of the certification model.

The certification model reimagines the recognition of learning outcomes by offering digital credentials that are transparent, verifiable, and aligned with industry demands. Learners are empowered to showcase their skills, while employers gain access to a reliable and standardized way to assess candidates' qualifications.

In a rapidly changing educational landscape, the certification model adapts to the needs of learners seeking personalized pathways and up-to-date competencies. The integration of technology, competencies mapping, and secure verification mechanisms ensures that digital credentials remain relevant and accurate.

The implementation of the certification model is not without challenges. Addressing concerns related to data security, standardization, and credibility requires collaboration among stakeholders. Yet, overcoming these challenges opens doors to a future where digital credentials revolutionize how skills are communicated and valued.

As education and the job market continue to evolve, the certification model holds the potential to redefine the language of qualifications. It may lead to the standardization of learning recognition on a global scale, emphasizing practical skills over traditional degrees.

The certification of learning outcomes transcends the confines of traditional education. It embodies a vision where learning is recognized, valued, and shared in a manner that empowers individuals, propels careers forward, and fosters a culture of lifelong learning. The certification model, intricately woven into the fabric of EaaS, stands as a beacon of progress, bridging the gap between education and the demands of a dynamic and digitally driven world. As we move forward, the certification model serves as a testament to the transformative power of education to shape a brighter future for learners, employers, and societies at large.

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## 4 . A6.2 Extra 7. Analysis of the impact of AI on the competencies of university graduates (TSI)

This section is devoted to research into the problems facing the development of higher education in the context of the emergence and active use of artificial intelligence, covering both technical, social and humanitarian fields and used in writing the article [1].

In the mid-20th century, Hannah Arendt, a German-born American philosopher, pointed out that "Whereas the often mentioned "lag" of the social sciences with respect to the natural sciences or of man's political development with respect to his technical and scientific know-how is no more than a red herring drawn into this de-bate; it can only divert attention from the main problem, which is that man can do, and successfully do, what he cannot comprehend and cannot express in everyday human language" [2]. Perhaps today, with the rise of artificial intelligence, experts from various fields of knowledge must work to grasp and express this new development and its impact on university management and education.

And if previous research was mainly focused on improving individual structural and functional components of existing universities, such as administration, technology, teaching technology, methods and forms, pedagogical design of educational materials, control, and assessment of competencies, today it has become necessary to re-consider the concept of the university model.

This became possible in connection with the real creation of special Artificial Intelligence (AI), which combined the solution of most of the problems of higher education. All this has become real in connection with the creation of a developed IT infrastructure of universities and the achievement of a significant level of

digitalization in society. In other words, conditions have been created for the emergence of the university of the future, the structure of which and the main ones must be redefined.

## 2.1 Historical Review

In fact, we should talk about the human development ecosystem and the role of educational institutions in it [3-5]. We are on the verge of a significant transformation of the university in its established form. This is primarily due to the main role that he played at different stages of society. The emergence of new workable tools that implement the functionality of artificial intelligence creates the prerequisites for a more rapid change in the role and mission of education in the new society.

The brewing revolutionary transformation of universities, the need for which is actively discussed in the academic environment, with the advent and lightning-fast spread of the application of AI forces us to talk about a new generation of educational environments [6-12]. If several authors [13-16] talk about the observed transformation of universities and the transition period to universities of the third and fourth generations, the beginning of the mass practical application of AI, at the level of an ordinary computer user, creates real opportunities for a jump-like transition to this new generation of the educational environment, which the authors for simplicity in this article will call the university of the fifth generation.

In this case, the proposed in [17] the university's generation classification system can be expanded (Table 1). In the [18] four generations of universities are described. The authors propose the fifth generation of universities with AI as a core element of the new ecosystem.

**Table 1.** Generations of Universities [1]

	<b>1st generation</b> (Steinbuch, 2016)	<b>2nd generation</b> (Steinbuch, 2016)	<b>3rd generation</b> (Steinbuch, 2016)	<b>4th generation</b> (Steinbuch, 2016)	<b>5th generation</b> (proposed by authors)
<b>Objective</b>	Education	Education, research	Education, research, know-how exploitation	Education, open innovation (research)	Innovation, creativity. critical thinking
<b>Role</b>	Defending the truth	Discovering nature	Creating value	Enabling value creation	Forming the basis for creative competencies
<b>Method</b>	Scholastic	Modern science, monodisciplinary	Modern science, interdisciplinary	Multi-actor innovation	Holistic
<b>Human capital development</b>	Professionals	Professionals, scientists	Professionals, scientists, entrepreneurs	Professionals, scientists, entrepreneurs, customers, ecosystem participants	Creator
<b>Orientation</b>	Universal	National	Global	Ecosystem	Universal
<b>Language</b>	Latin	National languages	English	English	Multilingual
<b>Organization</b>	Colleges	Faculties	Institutes and centers	Innovation spaces	Hybrid (physical and virtual) education environment
<b>Management</b>	Chancellor	Part-time academics	Professional management	Disruptors	Support of AI-based decision making

One of the main functions of universities has always been the generation and pro-vision of knowledge to a person for adaptation to new conditions generated by his information, technological and sociocultural environments. At the same time, if for the universities of 1st generation (U1G) and 2nd generation (U2G), the university itself and its environment were practically the only sources of knowledge (Fig. 1a), the formation of the university of 3rd and 4th generations of universities (U3G and U4G) was associated with the development of information technology, the exponential growth of knowledge (Fig. 2) [19] and the emergence of publicly available tools for individual access to information resources, such as search engines (Google, etc.), social and professional networks, etc., which not only expanded but also began to replace the capabilities of universities in terms of providing knowledge (Fig. 1b).

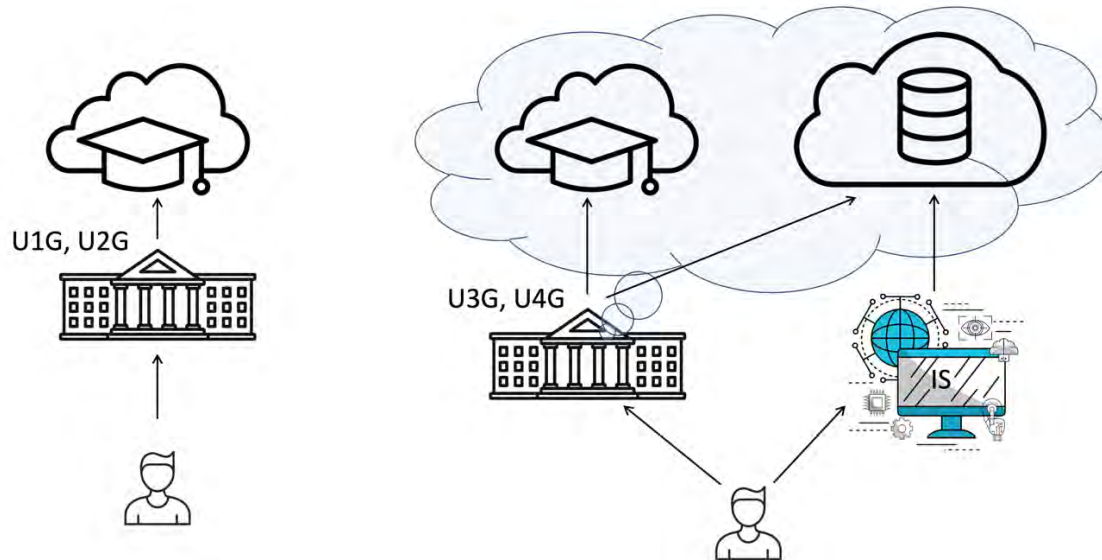


Figure 1. University as the source of knowledge [1]:

(a) -1st and 2nd generations of university, (b) - 3rd and 4th generations of university

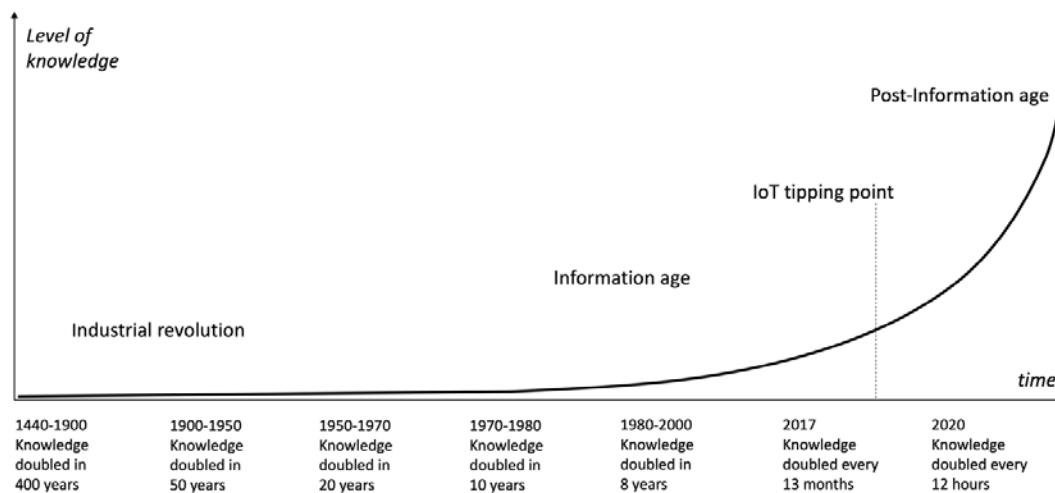


Figure 2. Acceleration of Knowledge Growth (Epi, 2021)

The emergence of AI tools that are also available for mass use further changes the possibilities for the user, providing him not only with access to information resources but also with the ability to generate and select concentrated knowledge in various professional fields. In such conditions, the niche of the university is shifting primarily to the field of the formation of human competencies that cannot be provided by artificial intelligence or are required for the development and application of this AI in new areas and areas, i.e. for the development of creative and emotionally-oriented competencies, taking into account the individual characteristics of the individual, which in the future will allow him to use the capabilities of AI to build and go through an individual learning path to achieve personal goals and objectives formed by this individual (Fig. 3).

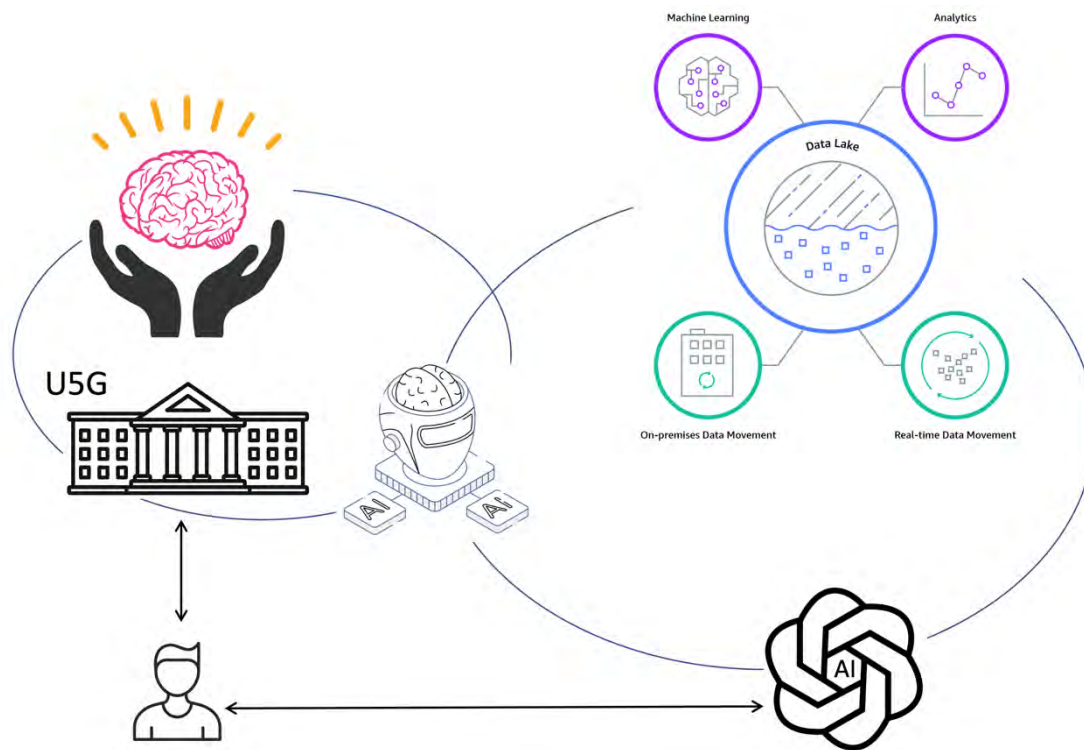


Figure 3. Artificial Intelligence as the source of Knowledge in the 5th generation of university

## 2.2 TITLE Artificial Intelligence, and new competencies of university graduates

Discussing the use of AI, we need to look at the existing different viewpoints on the relationship between conscious thinking processes and the ability to calculate. Well-known author Roger Penrose holds an approach that consciousness arises from certain physical actions of the brain, however, these actions cannot be computationally modelled correctly. He points out the "weakness" of this approach, implying that sooner or later the problem will be studied in enough detail. As a result, people will be able to identify the kinds of actions performed by conscious thought that are currently beyond "calculations" [10]. We believe that with the advent of artificial intelligence, which can model the actions of conscious thinking, we are entering a new era of solving many tasks that can be performed not by a person, but by artificial intelligence, including the possibility of using more complex forms of thinking.

Artificial intelligence will affect several important forms of activity, primarily society. Many areas of activity will be transformed, new competencies will be required, for example, an "AI operator", who must train



AI in relevant areas, ask the right questions in a dialogue, integrate individual patterns created by AI into a single picture, depending on the purpose and objectives of what caused the need for AI.

AI services will significantly change the requirements for professional competencies, and completely new competencies will become mandatory for university graduates to meet the demands of society.

Here we publish the answer received from artificial intelligence OpenAI ChatGPT to the question: “What specific competencies for employees are directly caused by AI services?”:

The implementation of AI services can lead to a shift in the skills and competencies required for employees. Some of the specific competencies that may be in high demand because of AI include:

1. **Data analysis and interpretation:** As AI systems generate large amounts of data, employees will need to be able to analyse and interpret this data to make informed decisions.
2. **Technical skills:** Employees will need to have a strong understanding of AI technologies, including machine learning, natural language processing, and computer vision, to effectively utilize and manage AI systems.
3. **Project management:** The integration of AI into an organization requires careful planning and coordination, and employees with project management skills will be in high demand.
4. **Ethical decision-making:** AI systems can have significant ethical implications, and employees will need to be able to make informed decisions about the appropriate use of AI, including considerations around data privacy, bias, and transparency.
5. **Adaptability:** As AI continues to evolve and new technologies emerge, employees will need to be able to quickly adapt to new tools and processes to remain relevant and effective in their roles.

In addition to these specific competencies, it's also important for employees to have a strong understanding of the broader business context and the strategic goals of the organization. This will allow them to effectively leverage AI to support the organization's mission and drive business outcomes.”

AI will require new competencies that go more (probably) into the emotional-cognitive area of human development. This will probably become a “top” level task for the university.

On the other hand, more down-to-earth AI service competencies for direct contact with AI will be required. This could become a “lower” level task for universities.

Today, AI cannot fully perform some functions necessary in the process of student learning. Without referring to narrowly subject-specific competencies, let's identify general functions that are problematic areas in AI-assisted learning:

- **multicultural education organization:** considering national and religious features and traditions of the subjects of learning and their gender differences.
- **motivational support for learning:** forming students' understanding of the need to complete work and its prospects; developing organizational and voluntary abilities; students' responsibility.

- cognitive development of students in some areas of knowledge: critical, creative thinking; students' understanding of the studied educational material; development of the ability to reason, draw conclusions and make decisions; spatial orientation training, etc.
- providing psychological and emotional support for learning: improving the ability to manage emotions both in the process of individual and group learning; organizing group work and distributing responsibilities among students.
- development of communicative interaction and abilities: presentation and public speaking; oratory and art, eloquence, dialogues, discussions, debates, brainstorming, etc.

The presented shortcomings in teaching with the use of AI do not allow us to completely abandon the role of a teacher in the educational process, even for example, such a task as drawing performed by AI causes controversy among specialists as to whether the picture presented by AI is a work of art.

## 2.3 Model of university with artificial intelligence

The first logical question appears as “what types of academic activities could be implemented by AI at a university?”. It's difficult to predict which specific administrative and academic units at a university may be replaced by AI, as the extent to which AI will impact different areas will depend on a variety of factors, including the level of technological advancement, the rate of adoption of AI systems, and the requirements of each unit.

However, it is possible that AI could be used to automate certain tasks and processes within administrative units such as finance, human resources, and student services, reducing the need for manual labour and improving efficiency. In academic units, AI could be used to grade assignments, provide personalized feedback to students, and support research through data analysis and visualization.

It's important to note that AI is unlikely to completely replace human administrators and educators, but rather augment their work and free up time for higher-level tasks and interactions with students and colleagues. There are several areas within a university's digital space that could benefit from the integration of AI:

1. Student services. AI can be used to automate repetitive tasks such as answering frequently asked questions and providing personalized support to students.
2. Learning management systems. AI can be used to provide personalized learning experiences, including intelligent recommendations for course materials, adaptive learning paths, and real-time feedback.
3. Research support. AI can assist researchers with data analysis, visualization, and discovery of new insights and patterns.
4. Administration. AI can automate tasks within administrative units such as finance and human resources, improving efficiency and freeing up time for higher-level tasks.

5. Campus safety. AI can be used to monitor and analyse security cameras, detect potential threats, and respond to emergencies in real-time.

For these transformations to be successful, universities will need to ensure that their IT infrastructure is up-to-date and capable of supporting AI systems and that they have a clear strategy for how AI will be integrated into their operations. Additionally, universities will need to invest in the training and development of their staff, to ensure that they are able to effectively utilize AI technologies and respond to any challenges that arise [20-22].

As is clearly visible from the picture Fig.4 the 5th generation of universities operated by AI and managed by external administration becomes a universal educational establishment as a part of a global information system supported by the Internet.

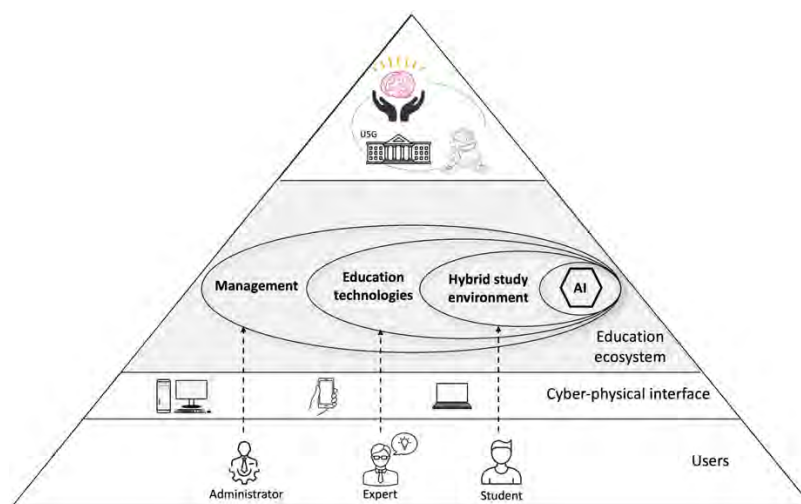


Figure 4. Suggested Conceptual Model of the 5G University

Let us clarify that in this model the term expert includes specialists in the design of training, the development of educational technologies, including methodological materials, the implementation of IT technologies, and issues of information security and law. The term administration conditionally includes both supervisory, and legislative bodies, and the main stakeholders of the university (for example, the founders).

The educational environment of the university is hybrid (Fig. 5) and includes both a real physical environment, focused primarily on experimental laboratory research, and a virtual environment in which AI can play a significant role.

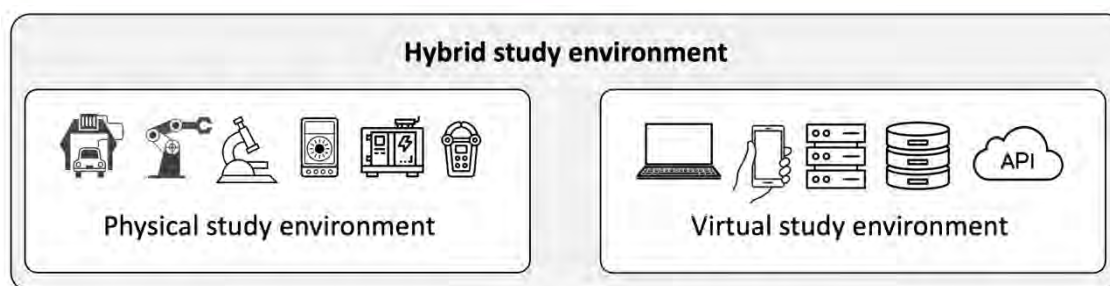


Figure 5. Hybrid study environment of U5G ecosystem

One more logical question appears “could we create a university as educational services supplier fully using IT Technology?”.

And we have the clear answer “Yes for most areas of human activity!”. It is possible to create a university that provides educational services using IT technology. This is commonly referred to as an online or virtual university.

At present, despite the presence of weak points in AI in the learning process, with appropriate settings and preparation, AI can:

- develop the structure and content of educational programs and courses in various areas of study.
- organize online learning with the provision of up-to-date learning materials.
- evaluate students' work and provide feedback after preliminary training.
- analyse the learning process to develop recommendations for individual learning trajectories for students.

Thus, we can see that AI can take on significant functions of the teacher, which will undoubtedly be reflected in his or her work. The fading of certain functions that the teacher performs should be replaced by scientific and creative activities.

Already today students can access course materials and engage with their instructors and classmates through a variety of digital platforms, such as learning management systems and virtual classrooms. This model allows for flexible and accessible education, as students can complete coursework and earn degrees from anywhere with an internet connection.

However, it's important to note that creating a successful online university requires significant investment in technology, instructional design, and student support services. The university must also have a robust and secure infrastructure and a strong commitment to delivering high-quality educational experiences.

Additionally, while online education has become increasingly popular in recent years, there is still some debate about the effectiveness of online learning compared to traditional, in-person education. As a result, online universities must work to establish credibility and prove the value of their degrees to potential students, employers, and the broader academic community.

## 2.4 Conclusion

Summarizing the above, the authors argue that the quantitative changes in modern society associated with digitalization in general and with the success in the applied use of artificial intelligence (intelligent systems) have led to the need for a qualitative change in higher education. The section shows that to meet the changing needs of society in the training of its new members and the retraining of working people, it is necessary to create a new type of higher educational institution (new university). This new university will be based on IT technologies with artificial intelligence as the core element of management and education processes. The role of administration and academic staff will change dramatically. The authors proposed a model of a new university and named its main functions. An essential element of the new university will be the focus on new competencies that members of the information society will need to learn. The changes will be so significant that they will be problematic for a long time to be perceived by the academic community and will call for discussions and objections. The section proposes the first steps necessary to form the acceptance of a new type of university in society and ensure a gradual transition to a new model of higher education.

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## 5 . A6.3 Development of model for competence-based industry mentoring (UMU)

A key effort to promote professional development and knowledge transfer across industries is the creation of a model for competence-based industry mentoring. This model emphasises the acquisition and use of practical skills relevant to particular industrial requirements, in line with the concepts of competence-based education (CBE). Industry mentoring is crucial in helping people find fulfilling career pathways because it pairs them with seasoned mentors who can provide advice, insights, and support in developing the skills necessary to succeed in the workplace. In addition to outlining critical competences, this endeavour aims to create a systematic framework that fosters a mutually beneficial mentoring relationship between mentors and mentees, thereby augmenting worker capacities in general.

The complexities of developing an organised framework to improve knowledge transfer and professional development are covered in this report. The report's first section looks at the core concepts of CBE and how they relate to industrial mentoring. This section outlines the core competences required for success in various professions, emphasising the practical skills and understanding required. The report then delves into the nuances of setting up successful mentorship guidances, including ideas for matching mentees with seasoned experts and creating an engaging learning atmosphere. The research highlights the mutual advantages of knowledge exchange and discusses the symbiotic relationship between mentors and mentees. The report offers significant insights into the design, implementation, and anticipated outcomes of the model, making it a important tool for organisations looking to maximise competence-based industry mentorship programmes.

### 5.1 Introduction

In the context of knowledge transfer and professional development, creating a competence-based industry mentoring model is an important endeavour (Mara, Hunyadi and Mara, 2015). This approach, which is consistent with CBE, emphasises the development and use of practical skills that are suited to particular industry needs. The essence of industry mentoring is its capacity to direct people towards satisfying career paths by matching them with seasoned mentors who provide priceless counsel, insights, and encouragement. Building a competence-based industry mentoring model is critical in today's environment of knowledge transfer and professional development. Traditional educational paradigms might not be sufficient to provide people with the practical skills and proficiencies that a variety of industries demand in today's quickly changing work environment (Herrmann *et al.*, 2023). A solution is offered by CBE, which places a strong emphasis on acquiring

skills that are directly related to particular job requirements. But putting these ideas into practise in the real world requires a calculated approach, which is where competence-based industry mentoring comes into play.

Converting theoretical knowledge into practical competences is accelerated through mentoring (Wahlgren, Mariager-Anderson and Sørensen, 2016). By offering individuals tailored guidance, insights, and advice from seasoned professionals who have successfully navigated the complexities of their respective industries, it bridges the gap between academic learning and workplace requirements (Robertson, 2023). In addition to improving the mentees' skill sets, this direct, experiential learning approach promotes a deeper understanding of the nuances and challenges of the industry (Sinha, 2023).

Moreover, the development of career pathways is aided by competence-based industry mentoring (Sanfey, Hollands and Gantt, 2013). A model can assist mentees in navigating their careers more skillfully by matching them with mentors who have successfully travelled similar professional paths (Lepre-Nolan and Houde, 2023). This is especially important in today's workplace, where career paths are frequently complex and call for a blend of hard skills, soft skills, and industry-specific knowledge.

Another important factor in promoting a culture of lifelong learning is the mutually beneficial relationship that is present in mentoring. While mentees gain from the wealth of experience and expertise of their mentors, seasoned professionals benefit from the new perspectives and creative insights of their mentees. The dynamic learning ecosystem that results from this mutual knowledge exchange is crucial for both the professional development of the individual and the industry's overall resilience in the face of changing challenges (Kindermann *et al.*, 2022).

The aim of this report is to simplify the complex process of creating a structured framework that enhances knowledge transfer and promotes professional growth. The following sections delve into the fundamental ideas of competence-based learning and examine how they apply to industrial mentoring. The study highlights the mutual benefits of knowledge sharing and sheds light on the symbiotic relationship that exists between mentors and mentees.

### 5.1.1 Background

Since the field of professional development is always changing, new strategies for promoting competence and knowledge sharing across industries are required. A guiding concept that emphasises the practical skills and proficiencies necessary for success in particular vocational domains is CBE. Given the acknowledged transformative power of mentoring, especially in industrial settings where complex and demanding workplace dynamics exist, it becomes clear that a model specifically designed for competence-based industry mentoring is required.

Rapid changes in the modern professional environment necessitate a reassessment of conventional methods for professional development. CBE has become a guiding philosophy in response to this changing environment, emphasising the acquisition of practical skills necessary for success in particular vocational domains. This

educational paradigm emphasises the need for a more focused and hands-on approach, acknowledging the shortcomings of traditional models in meeting the changing demands of industries.

Mentoring is a personalised and dynamic learning experience that connects individuals with skilled professionals who share their knowledge, experiences, and insights. It transcends traditional training approaches. This relationship fosters a rich knowledge exchange that is advantageous to both parties as well as helping the mentees develop their skills. Understanding the importance of this mutually beneficial relationship, this report explores the fundamental ideas of competence-based learning and the complex workings of successful industry mentorship programmes. Organisations are better equipped to strategically navigate the complexities of professional growth and knowledge dissemination when they recognise the synergies between educational principles and practical application.

In this context, it becomes clear how important mentoring is in converting theoretical knowledge into practical competences. Mentorship, in contrast to traditional training methods, provides a dynamic and personalised learning experience by pairing individuals with seasoned professionals who act as mentors, advisors, and sources of industry knowledge. This direct interaction promotes a deep exchange of ideas and experiences in addition to skill development by facilitating a comprehensive understanding of the nuances of the workplace.

The particular difficulties presented by industrial settings give rise to the need for a model tailored to competence-based industry mentoring. In addition to having theoretical knowledge, people working in these environments must be able to navigate the complexities and subtleties of real-world scenarios. The mentorship model must be designed to establish a mutually beneficial relationship between mentors and mentees, in line with the tenets of CBE.

### 5.1.2 Importance of competence-based education

CBE is a revolutionary approach to education that prioritises the development and use of transferable skills over traditional rote learning. CBE is becoming increasingly important in today's educational environments for a number of reasons explained below.

- **Relevance to real-world demands:**

By emphasising the practical competences needed in professional settings, CBE connects education with the changing demands of industry. This connection guarantees that graduates will be prepared to handle the complexities of their chosen fields.

- **Holistic skill development:**

CBE seeks to foster a broad range of skills, in contrast to traditional education, which may place a higher priority on theoretical knowledge. Students gain a deeper understanding of how to apply knowledge in real-world scenarios through hands-on activities in addition to theoretical concepts.

- **Adaptability and lifelong learning:**



Modern professions are dynamic, which necessitates adaptability. CBE fosters a culture of lifelong learning, enabling people to pick up new skills at any point in their professional lives. This flexibility is essential in fields where technology is advancing quickly.

- **Tailored educational journeys:**

CBE acknowledges that students advance at varying speeds and possess distinct aptitudes. It takes into account different learning styles and makes sure that every student achieves proficiency before moving forward by enabling customised learning paths.

- **Enhanced problem-solving capabilities:**

CBE fosters strong problem-solving abilities by placing a strong emphasis on practical application. Pupils acquire the skills necessary to analyse problems, apply their knowledge, and come up with workable solutions—a critical set of abilities in professional settings.

- **Employability and career readiness:**

CBE directly addresses the gap between academic knowledge and workplace demands. Graduates are not only academically qualified but also possess the skills and competences sought by employers, enhancing their employability and readiness for the workforce.

- **Measurable outcomes:**

CBE includes quantifiable learning objectives that make it possible for teachers and students to efficiently monitor students' progress. This emphasis on results makes it easier to evaluate educational programmes' efficacy in a transparent manner.

- **Global competitiveness:**

People need cross-cultural and cross-border transferable skills in today's globally interconnected world. Through the acquisition of globally competitive competences through CBE, students become more employable everywhere.

- **Reactive to industry changes:**

As a result of market fluctuations and technology breakthroughs, industries are prone to quick changes. Because of CBE's flexibility, educational institutions can quickly modify their curricula to better prepare graduates for new challenges and trends.

## 5.2 Proficiency in career advancement

Proficiency is a key component in today's professional development and career advancement landscape, driving people to success in their chosen fields. Being proficient is more than just showcasing one's abilities; it's about having a thorough understanding of all the skills needed for a particular job or industry. Professionalism is becoming more and more important as industries change and workplace dynamics are constantly evolving. It acts as a potent catalyst, empowering people to successfully manage the challenges of their jobs and make significant contributions to the advancement of their companies as a whole.

The idea of lifelong learning is inextricably linked to the pursuit of proficiency. In an ever-evolving world of knowledge, people who are dedicated to their careers understand that they must constantly improve their abilities and keep up with industry developments. When professionals are positioned as indispensable contributors who can solve new problems and spur innovation, proficiency turns into a strategic asset. Furthermore, in a time when employers are looking for candidates who can make an impactful contribution right away and where competition is fierce, proficiency turns into a differentiator that propels people's careers forward.

Proficient people are a tangible indicator of their ability to produce results, especially in industries where tangible contributions and outcomes are valued highly. Proficiency communicates to peers and employers that a person is not just competent in their role but also thrives in it, regardless of whether the proficiency is based on technical expertise, leadership acumen, or a sophisticated understanding of industry intricacies. The foundation of a rewarding and upward-facing professional path is laid by this recognition, which in turn opens doors to new opportunities, promotions, and leadership roles.

### 5.2.1 Essential Skills for Career Success

A career's success in today's competitive and dynamic professional environment is largely dependent on a few key competences. These are broader skills that enable people to succeed in a variety of work environments, going beyond the specialised technical competences required for a given job. Acknowledging and developing these critical abilities is important for personal development, career progression, and overall job satisfaction.

- **Communication skills:**

Success in any career depends on one's capacity for clear thought, attentive listening, and effective idea transmission. Effective problem-solving and collaboration are made possible by strong communication skills, which also help to foster positive relationships with superiors, clients, and coworkers.

- **Critical thinking and problem-solving:**

Getting through the complexity of today's workplaces calls for the ability to critically assess situations and come up with workable solutions. Those who possess the ability to think strategically and come up with creative solutions for problems make a significant contribution to their organisations.

- **Flexibility and adaptability:**

In a world where things change quickly, professionals need to be flexible and willing to pick up new skills. Those who are adaptable can thrive in dynamic environments, accept change, and navigate shifting priorities. This allows them to establish themselves as dependable members of their teams.

- **Teamwork and collaboration:**

The capacity to collaborate with others is a prerequisite for success in many professional contexts. In addition to offering one's expertise, teamwork entails appreciating different viewpoints, creating a supportive team environment, and working together to accomplish common objectives.

- **Leadership skills:**

Influencing people, assuming initiative, and seeing projects through to completion are all parts of being a leader that go beyond official positions. People with leadership qualities, even in non-managerial roles, instill confidence and enhance the overall performance of their teams.

- **Time management:**

Being productive and efficient requires having good time management skills. Professionals who can successfully manage responsibilities and contribute to organisational success are those who can prioritise work, meet deadlines, and strike a balance between competing demands.

- **Emotional intelligence:**

Emotional intelligence, or the ability to understand, regulate, and navigate one's emotions as well as interpersonal relationships, is necessary for professional success. Individuals possessing emotional intelligence are more adept at creating enduring relationships, settling conflicts peacefully, and fostering a positive work atmosphere.

- **Continuous Learning:**

An unwavering dedication to lifelong learning is essential in a world where knowledge is advancing swiftly. Professionals who adopt a continuous learning mindset stay ahead of industry trends, pick up new abilities, and establish themselves as valuable contributors in a field that is changing quickly.

### 5.2.2 Acquisition of knowledge and useful skills

The foundation of both professional and personal development is the lifelong process of acquiring knowledge and practical skills. The quest of knowledge and skills is more important than ever since industries are shaped by innovation and dynamic shifts. This complex process entails deliberate learning, practical experience, and ongoing adaptation to remain current in a variety of fields.

Formal education is a fundamental component that provides individuals with the necessary knowledge and theoretical frameworks to succeed in their chosen fields. It provides structured knowledge. Beyond this formal education, practical experiences are crucial for the acquisition of skills. Through the testing ground of real-world situations, internships, apprenticeships, and on-the-job training bring theoretical concepts to life and develop practical skills.

The dynamic evolution of industries necessitates active engagement in continuous learning. Workshops, certifications, and professional development programmes offer focused experiences that improve particular skills or expose people to new ideas, keeping them competitive and flexible. Through online tutorials, courses, and educational resources, self-directed learning has become possible in the digital age, democratising education and enabling people to pursue new skills on their own and customise their education to suit their interests and needs.

Establishing mentorship relationships with seasoned professionals is an effective way to learn. Mentors provide insights and useful guidance based on their experiences. Professional communities provide a forum for knowledge exchange, exposing people to a range of viewpoints. Acquiring soft skills is essential in addition to technical proficiency. Interpersonal skills, problem-solving abilities, adaptability, and effective communication all support the development of professional relationships and overall career advancement.

Exposure to different aspects of a company or industry leads to the development of a comprehensive skill set. Working on cross-functional projects or interacting with coworkers from different backgrounds increases comprehension and develops a variety of transferable skills. The process of gaining knowledge and practical skills is not linear; rather, it involves a variety of situations, experiences, and methods. It is an endeavour shaped by experience, curiosity and an ever-present desire to learn new things, combined with formal education and exposure to the real world. In addition to advancing individual careers, this organic and flexible approach fosters the creativity and adaptability of the industries they work in.

### 5.3 Framework for competence-based industry mentoring

A competence-based industry mentoring framework serves as a strategic roadmap for navigating the complex landscape of professional development and knowledge transfer across industries. Based on the principles of CBE, a framework must prioritise the development of practical skills crucial for success in specific professional fields. The framework must recognise the significance of mentoring in professional contexts, highlighting its pivotal role in providing personalised and engaging learning opportunities.

Basically, a framework should aim to create a mutually beneficial relationship between experienced mentors and mentees in order to close the gap between theoretical knowledge and practical application. This relationship ought to go beyond traditional training techniques and provide a wealth of knowledge, experiences, and insights. By outlining the core competences required for success in a variety of careers, the framework ought to enable people to participate in a customised learning experience that corresponds with the constantly changing needs of the labour market. It must stress the value of a methodical approach to mentoring programmes, focusing on strategies for successful mentor-mentee matching and the development of a stimulating learning environment.

The framework ought to explore the complexities involved in creating and executing effective mentorship initiatives, illuminating the reciprocal advantages that arise from sharing knowledge. Organisations can optimise the effectiveness of competence-based industry mentorship programmes by gaining valuable insights into the model's anticipated outcomes. The framework needs to function as a dynamic roadmap, encouraging an environment of ongoing education and skill building that advances people's career paths as well as industries' overall ability to adapt to changing conditions.

### 5.3.1 Guidelines for Successful Mentoring

Successful mentoring guidelines comprise an all-encompassing collection of ideas and methods designed to maximise the mentorship experience, promote growth in both parties, and enable a dynamic knowledge exchange. Fundamental to these recommendations is the understanding that successful mentoring transcends a one-size-fits-all strategy, customising the mentoring experience to the distinct requirements and goals of mentors and mentees.

The emphasis on goal-setting and clear communication is one essential component. Any successful mentoring relationship starts with a shared understanding of objectives, expectations, and desired outcomes. In order to match the objectives of the mentorship with the mentee's larger goals for professional development, this calls for transparent and open communication.

Creating an environment that is welcoming and positive for mentorship is another important rule. It is critical to establish an environment where mentees feel at ease discussing difficulties, asking for advice, and outlining their objectives. In turn, the mentor assumes a crucial role in offering helpful guidance, supportive assistance, and constructive criticism, all of which help the mentee's general development.

The guidelines also stress the value of adaptability and flexibility in mentoring relationships. Given the diversity and dynamic nature of career paths, the mentorship relationship should adapt to the needs and circumstances of the individual. This adaptability guarantees that the mentorship stays applicable, significant, and in line with the participants' changing objectives.

These rules act as a compass, assisting mentors and mentees in navigating the complexities of a fruitful mentoring partnership. Following these guidelines can help companies foster a mentoring culture that advances knowledge and skills in the industry as a whole while also helping individuals advance their career paths. The following are some guidelines to bear in mind:

- **Explicit goal-setting and communication:**

Successful mentoring relies heavily on effective communication, which calls for open and honest lines of communication between mentors and mentees. Clarity must be established early on in the relationship by outlining expectations, goals, and desired results for the mentorship. But because professional development is dynamic, it's also critical to remain flexible, periodically reviewing and modifying objectives in light of the changing needs of mentors and mentees. This constant communication makes sure that the mentorship stays in line with the evolving needs and goals of both sides.

- **Pleasant and cordial atmosphere:**

Creating a friendly and upbeat atmosphere is essential to effective mentoring. To do this, mentors should establish a welcoming atmosphere where mentees feel at ease talking about challenges, seeking guidance, and sharing their goals. It takes open communication and active listening to comprehend the varied perspectives and objectives of mentees. Furthermore, mentors play a crucial role in providing mentees with helpful feedback and



motivation, which propels their career development. This supportive environment not only promotes personal growth but also increases the overall effectiveness of the mentoring relationship.

- **Flexibility and adaptability:**

Since career paths are dynamic and varied, effective mentoring necessitates both flexibility and adaptability. Mentors must understand how important it is to be adaptable in their approach, taking into account the unique circumstances and evolving goals of their mentees. Being adaptable makes it possible to handle future adjustments and challenges, guaranteeing that the mentorship remains valuable over time. Additionally, by providing support for growth in a variety of areas, mentors play a crucial role in inspiring mentees to pursue a variety of career paths. With the help of this approach, mentees can advance in their careers with resilience and an open mind to new opportunities.

- **Knowledge sharing and mutual learning:**

A key component of successful mentoring is fostering a reciprocal exchange of information, insights, and experiences between mentors and mentees. Mentors should actively seek out opportunities to learn from the unique perspectives and experiences of their mentees in order to cultivate a collaborative environment. Mentorship relationships should promote a culture of continuous learning and curiosity in order to keep both parties engaged in the dynamic process of mutual growth. Mentorship is improved and both mentors and mentees are developed through a mutually beneficial learning process when there is a strong emphasis on reciprocal knowledge sharing.

- **Professional development advice:**

A key element of successful mentoring is providing insightful counsel on a variety of professional development subjects. Mentors are crucial because they help mentees set and achieve significant career goals, identify areas in which they can develop their skills, and offer guidance on career planning. Additionally, mentees can make well-informed decisions about their career paths thanks to the dissemination of industry insights, trends, and best practises. This all-encompassing strategy guarantees mentees receive full support and motivation to succeed in their career aspirations.

- **Building relationships and networking:**

Beyond helping people develop their skills, mentoring also allows to build strong professional networks. Mentors are essential because they provide mentees with networking opportunities and help them grow their professional network within the industry. Through the provision of guidance on the development of meaningful relationships, mentors enable mentees to effectively navigate the complexities of networking. Mentors also share their own wisdom and experiences, highlighting the significant importance of networking for professional growth. This cooperative approach guarantees that mentees develop a strong network that supports their long-term professional success in addition to gaining useful skills.

- **Honouring inclusivity and diversity:**

When it comes to mentoring, cultivating an environment at work that values diversity and inclusiveness is crucial. An appreciation for a range of experiences, viewpoints, and backgrounds is greatly aided by mentors. Mentors support an environment that is inclusive and values and respects individual differences in the workplace. Not only does this emphasis on diversity and inclusion enhance the mentorship experience, but it also fits in with the larger objectives of fostering fair and encouraging work environments.

- **Frequent assessments and check-ins:**

Ensuring the effectiveness of mentoring requires the establishment of a structured framework. Frequent check-ins are an important way to evaluate the relationship between mentor and student, discuss difficulties, and recognise successes. Regular assessments are carried out to carefully determine the overall efficacy of the mentorship, enabling modifications and enhancements. Both mentors and mentees are encouraged to participate in an open feedback loop, which creates a collaborative environment that continuously improves and refines the mentorship experience for all parties. This dedication to consistent evaluation and feedback highlights how dynamic and ever-changing successful mentoring relationships are.

### 5.3.2 Enabling mentors to connect with skilled experts

Facilitating mentors' access to knowledgeable professionals is essential to building a strong mentoring ecosystem. Through this alive partnership, mentors are able to reach a wide range of knowledgeable individuals, which promotes the exchange of information and increases their own level of expertise. Mentorees gain access to a wider range of perspectives and advice, which improves their educational experience, through providing mentors with opportunities to engage with industry professionals.

Platforms that enable these kinds of connections are essential to this process because they provide mentors with a controlled setting in which they can interact with experts without difficulty. These venues could be online communities, business gatherings, or niche discussion boards where mentors can connect with one another through common interests, industry specialisations, or skill sets. By removing geographical barriers and establishing a global community of mentorship, utilising technology to facilitate these connections guarantees a scalable and effective mentorship programme.

In the long run, mentors' capacity to establish connections with knowledgeable specialists enhances the mentorship process by bringing a variety of viewpoints and experiences into the learning environment. This interconnection helps the professional community as a whole and fosters a culture of knowledge-sharing, in addition to providing benefits to individual mentors and mentees.

### 5.3.3 Promoting an adaptive educational setting

Cultivating a dynamic learning environment that adapts to people's changing needs and preferences requires supporting an adaptive educational setting. Under such circumstances, educational establishments place a high value on adaptability, customising curricula to suit a range of learner types, interests, and paces. This flexibility

applies to both traditional and digital learning formats and acknowledges the importance of utilising technology to increase accessibility and engagement.

In an adaptive learning environment, students can explore areas of interest and progress at their own pace thanks to personalised learning pathways that are prioritised. Technology, which employs analytics and data to assess student performance and modify course content appropriately, makes adaptive learning platforms possible. This approach considers each student's unique strengths and challenges, which fosters a more welcoming environment.

Adopting cutting-edge teaching techniques, routinely reviewing and updating curricula, and staying current with educational trends are additional requirements for fostering adaptability. This ensures that educational institutions continue to be responsive to changing industry needs, new technology, and changing career paths. Schools give students an environment that is flexible enough to help them navigate a world that is changing quickly. This assists students in acquiring the information and abilities required to be successful in a wide range of fascinating and diverse career paths.

## 5.4 The mutually beneficial nature of mentorship

Mentoring, in which experienced mentors share invaluable knowledge, experiences, and insights with mentees to help them develop their skills and advance in their careers, is a symbiotic relationship that goes beyond traditional learning methods. At the same time, mentorees provide fresh perspectives, innovative ideas, and a revitalised sense of purpose to their mentors. This mutually beneficial relationship creates a dynamic learning ecosystem that supports the success of both mentors and mentees. Mentors provide guidance based on their extensive careers, while mentees contribute vitality, contemporary viewpoints, and awareness of emerging trends. The result is a synergistic relationship that fuels the professional journeys of both parties. The essence of mentorship is defined by this reciprocal dynamic, which fosters a cooperative and empowering environment for growth on both sides.

### 5.4.1 Mutual gains from information sharing

A strong and fruitful mentoring relationship is built on the mutual benefits of information sharing, which advances the careers of both mentors and mentees. In this mutually beneficial relationship, mentors provide mentees with invaluable knowledge by drawing on their extensive experience, industry insights, and practical wisdom. Mentees receive guidance on navigating their careers, comprehending industry nuances, and anticipating potential challenges through this mentor-driven knowledge transfer.

Conversely, mentees offer a new outlook, creative concepts, and a modern comprehension of developing trends and technologies. Through this mutual information exchange, mentors remain abreast of current advancements and can take advantage of the mentees' varied experiences and current expertise. Because of their collaborative nature, the two of them actively support each other's personal and professional development in a dynamic learning environment.

In a mentoring relationship, knowledge is shared not only through theoretical talks but also through practical applications and real-world scenarios. Mentors' insights can be applied by mentees to their daily work, which improves their skills and ability to make decisions. Mentors stay up to date with the changing landscape in their respective industries by being exposed to new challenges and creative solutions at the same time.

Benefits from this process of reciprocal learning extend beyond the mentor-mentee relationship and form a positive feedback loop. The knowledge and abilities mentees gain via mentoring not only help them succeed in their careers but also have a positive impact on the mentor. This long-lasting mentoring ecosystem promotes ongoing professional development, illustrating the long-lasting influence of benefits from information exchange in developing prosperous and well-rounded professionals.

#### 5.4.2 Establishing robust mentoring relationships

Building strong mentoring relationships is a determined process that requires both mentors and mentees to pay close attention to important details. Establishing shared expectations, objectives, and responsibilities requires open and honest communication. This precision guarantees that the mentorship is in line with particular goals, eliminating uncertainty and encouraging a targeted cooperation. The role of the mentor goes beyond giving general counsel; it also entails customising counsel to the particular requirements and goals of mentees. The mentee's unique opportunities and challenges in their career path are addressed through a personalised approach that guarantees the mentorship is impactful and relevant. The mentorship's trajectory is guided by constructive feedback and regular assessments of progress, which enable modifications and optimisations. The following are a few of the main points:

- **Clearly defined goals**

It is imperative to establish unambiguous expectations right away. Well-defined roles, responsibilities, and goals facilitate the alignment of the mentorship relationship with particular goals. By removing uncertainty, this clarity enables both sides to concentrate on attaining concrete results.

- **Honest interaction:**

Creating channels of communication that are transparent and open is essential. A healthy exchange of information is encouraged by fostering an environment where mentees feel comfortable sharing challenges, seeking guidance, and expressing their goals. Engaging in active dialogue guarantees that mentors comprehend the distinct viewpoints and goals of mentees.

- **Tailored counselling:**

It is imperative that mentors customise their guidance to each mentee's unique needs and goals. Mentors ought to offer tailored guidance that takes into account the unique obstacles and possibilities that mentees encounter in their professional endeavours. The mentorship's impact and relevance are increased by this customised approach.

- **Enhancement of skills:**

Mentors are essential in helping mentees develop their skills. Contributions to the mentees' ongoing development include pinpointing areas in need of improvement, recommending pertinent opportunities for professional development, and exchanging industry insights. This method of skill-centric mentoring guarantees that mentees gain the useful skills required for success.

- **Opportunities for networking:**

Encouraging networking opportunities is an additional aspect of a strong mentoring partnership. By putting mentees in touch with business leaders through their professional networks, mentors can facilitate opportunities for cooperation and exposure to a range of viewpoints. Through networking, mentees can expand their professional networks and advance their careers as a whole.

- **Positive criticism:**

Giving constructive criticism is an essential component. Mentees should receive constructive criticism from mentors that helps them grow. Acknowledgment of accomplishments along with helpful critiques inspires mentees to pursue ongoing development.

- **Fostering creativity:**

A key component of effective mentoring is pushing mentees to investigate novel strategies and consider problem-solving from an original standpoint. Mentors can encourage a mindset of creativity and adaptability in their mentees by encouraging them to question the status quo.

## 5.5 Anticipated results

It is expected that putting into practise a competence-based industry mentoring model will have a significant and diverse impact on individuals as well as organisations. Mentees can anticipate more rapid professional development on a personal level with customised guidance based on their specific competences and career objectives. The model should make it easier for them to gain real-world experience, understanding of the subtleties of the industry, and access to a wider network, all of which improve their employability and career prospects. Conversely, mentors gain the satisfaction of developing their coaching and leadership skills while helping the next generation succeed.

The anticipated results on an organisational level include a workforce that is more knowledgeable and flexible. The model places a strong emphasis on CBE, which guarantees that workers have the exact skills needed for their positions and promotes increased creativity and productivity. Building a strong mentoring culture strengthens an environment of cooperation and knowledge exchange, which increases an organization's competitiveness and resilience in fast-paced markets. Overall, this model should produce outcomes that go beyond organisational and individual growth, having a positive knock-on effect on the larger professional scene.



### 5.5.1 Strengthening career advancement

Creating and putting into practise a competence-based industry mentoring model is essential to supporting people's career advancement in a variety of work environments. This model should function as a flexible framework that combines theoretical knowledge with practical application to offer a methodical approach to professional development and skill acquisition. People who participate in mentorship relationships learn from skilled professionals' practical insights and experiences in addition to their theoretical knowledge.

Personalised guidance is one of the main ways that the model must support career advancement. The abundance of knowledge and insight that mentors provide to their mentees helps them overcome obstacles, establish specific goals for their careers, and develop the skills necessary for success in their fields. By utilising a customised approach, mentees can accelerate their learning curve, make well-informed decisions, take calculated career steps, and actively manage their professional trajectories.

Additionally, the model helps to build a professional community that is linked and cooperative. Through mentoring, people develop connections that may lead to new opportunities, widen their networks, and gain insightful knowledge of the industry. The focus on CBE guarantees that the skills learned closely match the changing needs of the industry, increasing people's adaptability and competitiveness in the labour market.

### 5.5.2 Knowledge transfer optimisation

Optimising knowledge transfer via the use of an industry mentoring model based on competence results in substantial benefits for individuals as well as organisations. An important component of this optimisation is the effective transfer of implicit knowledge. Years of real-world experience allow mentors to share best practises, insights, and real-world scenarios with mentees, speeding up the transfer of important tacit knowledge—which is frequently difficult to acquire through formal education alone.

The model also encourages a culture of ongoing learning and flexibility. The most recent methods, technologies, and trends in the industry are introduced to mentees, guaranteeing that their skill sets stay current and in line with the ever-changing demands of the workplace. By improving individual competences, this continuous learning approach helps mentees become more adaptable and sensitive to changes in their respective industries. Additionally, preserving institutional knowledge within organisations is aided by the optimisation of knowledge transfer. Institutional wisdom is seamlessly transferred as experienced professionals share their knowledge to up-and-coming talent, guaranteeing that crucial information is retained even in the event of staff changes. Maintaining organisational resilience during times of change or expansion, in particular, depends heavily on this continuity of knowledge.

The model's focus on practical abilities and real-world experiences ought to improve the knowledge's applicability. In addition to theoretical understanding, mentees acquire practical application skills. A workforce with this practical orientation is not only knowledgeable but also capable of driving innovation within their professional domains and solving complex problems.

## 5.6 Conclusion

In creating a model for competence-based industry mentoring, the research has produced important findings that highlight the initiatives' transformative potential in promoting professional development and knowledge transfer. The prioritisation of CBE principles has shown to be crucial in meeting the changing demands of the industries, guaranteeing that professional development prioritises practical skills and proficiencies. The model's success has been largely attributed to the symbiotic relationship that exists between mentors and mentees, which is marked by a reciprocal exchange of knowledge, experiences, and insights.

The importance of goal-setting and open communication at the start of the mentorship relationship is one significant finding. This basis lays the groundwork for an organised and goal-oriented interaction, enabling mentors and mentees to coordinate expectations and cooperate to achieve predetermined goals. In order to create a space where mentees feel empowered and supported to share challenges, seek guidance, and express their professional goals, the model's positive and inclusive environment has been crucial.

Since career paths are varied and dynamic, the model's inherent flexibility and adaptability must be essential. Because of their flexibility, mentorship programmes can change with the times and meet the objectives of the mentors. The model should emphasise knowledge sharing and mutual learning to create a rich, ongoing learning environment that supports the development of mentees as well as mentors.

There are a couple of recommendations for future implementation that could be made to improve the effectiveness of the competence-based industry mentoring model. Continuous improvement can be achieved by regularly evaluating the effectiveness of the mentoring relationship, encouraging open feedback from mentors and mentees, and continually assessing and improving the objectives of the mentorship. Incorporating cutting-edge technologies and creative teaching techniques can also enhance the mentorship experience and make sure it keeps up with changing industry trends.

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## 6 . A6.3. Extra 7. Automatic processing of natural language competences for DEMO application (UMU)

Automatic natural language processing (NLP) has become an important tool with broad implications for industry. This technology focuses on the ability of systems to understand, interpret and produce human language, which facilitates communication between users and technology. Research into the competences related to automatic NLP is needed as businesses and myriads of applications increasingly use of NLP tools. This report lays the groundwork for a deeper exploration of NLP in academic and professional competences, highlighting its importance in a variety of settings and its potential to completely transform the way companies recruit new employees.

### 3.1 Introduction

Finding the best qualified applicants is a constant challenge in the fast-paced hiring environment of the industry. NLP is playing a transformative role as businesses try to match their labour force to the needs of a more specialised and competitive market (Arslan and Cruz, 2022). The field NLP, which studies the relationship between computers and human language, has the potential to completely change how businesses assess and choose applicants based on their educational background (Raj *et al.*, 2023).

Assessing academic competence is one of the crucial areas where NLP can have a significant impact. In the past, standardised tests, resumes and interviews have played a major role in the hiring process, giving employers a

skewed view of candidates' actual abilities. Businesses can use NLP to explore the rich tapestry of academic accomplishments and extract sophisticated insights that surpass traditional metrics (Prester *et al.*, 2021). In addition to guaranteeing a thorough grasp of a candidate's educational background, this move towards a more holistic assessment makes it possible to find hidden talents and skills that might otherwise go overlooked.

Accuracy and efficiency are added to the hiring process by integrating NLP (Gonzalez *et al.*, 2022). Large volumes of textual data, such as research publications, recommendation letters, and academic transcripts, can now be automatically parsed and analysed thanks to this technology. As a result, it reduces the possibility of oversight and quickens the screening process, guaranteeing that no important piece of information is missed. Consequently, hiring managers are able to concentrate their efforts on finding applicants whose academic backgrounds mesh well with the job's requirements.

Furthermore, the incorporation of NLP causes a paradigm shift in the way business views and values academic competences. NLP enables an intricate assessment of a candidate's language competence, communication skills, and depth of understanding in their field of study, going beyond the traditional emphasis on grades and degrees (Li *et al.*, 2022). Organisations can acquire valuable insights into a candidate's capacity for communicating intricate concepts, working well in teams, and making a significant contribution to the workplace by evaluating not only the content but also the way it is presented on a resume.

Moreover, NLP makes it easier to tailor competence evaluations to the particular needs of different positions and industries. Through customization of the analysis to particular linguistic patterns and terminologies used in specific industries, businesses can guarantee that the theoretical competences meet the practical requirements of the position. This flexibility improves the assessment's relevance and helps to develop a workforce that is capable of handling challenges unique to the industry in addition to being academically strong.

For industry hiring, the inclusion of NLP in the assessment of academic competences offers a game-changing opportunity (Alqahtani *et al.*, 2023). Organisations can cultivate a workforce that possesses remarkable abilities and diverse perspectives, in addition to identifying the most qualified candidates, by adopting a more comprehensive and subtle approach that goes beyond traditional metrics. With the increasing collaboration between academia and industry, NLP has the potential to be a potent enabler for talent discovery and innovation in the workplace (Votto *et al.*, 2021).

### 3.1.1 Natural language processing overview

Syntax, artificial intelligence, and linguistics all converge in the dynamic and multidisciplinary field of NLP. Understanding, interpreting, and responding to human language in a meaningful and contextually appropriate manner is the fundamental goal of NLP.

NLP's main goal is to close the gap between machine and human language comprehension in order to enable smooth interaction and communication. Important elements of NLP consist of:

- **Text analysis and understanding:**

NLP algorithms analyse textual data by dissecting linguistic structures to pinpoint entities, connections, and emotions. This includes named entity recognition, sentiment analysis, and part-of-speech tagging.

- **Speech recognition:**

NLP expands to include oral language, allowing machines to translate spoken words into text. Voice-activated systems, virtual assistants, and other applications where spoken human-machine interaction is critical require this capability.

- **Machine translation:**

By creating algorithms for automatic language translation between various languages, NLP is essential in breaking down linguistic barriers. International communication and intercultural cooperation will be significantly impacted by this.

- **Question-answering systems:**

NLP is the primary technology used to develop these systems, which can understand user questions and provide relevant responses. These systems usually employ semantic analysis to decipher the questions' meaning.

- **Virtual assistants and chatbots:**

The rise of virtual assistants and chatbots is proof that NLP has influenced the design of conversational user interfaces. These programmes have the ability to understand user input, respond appropriately, and even learn new abilities with continued use.

- **Sentiment analysis:**

This technique looks at textual data, like reviews and social media posts, to ascertain the overall sentiment of the public. It is employed by businesses and organisations. Real-time insights into public opinion are made possible by this.

### 3.2 Academic competences

The abilities, knowledge, and skills obtained through formal education are known as academic competences. These skills are varied and include subject-matter knowledge, analytical skills, research prowess, and proficient communication. Exams, projects, and other forms of evaluation are frequently used to measure academic competences in order to determine a learner's level of proficiency in a given subject. These competences lay the foundation for future professional endeavours by providing people with the intellectual tools they need to succeed in their chosen academic or professional pathways.



### 3.2.1 Integration of NLP in an educational setting

The application of NLP in the classroom has the potential to drastically alter how students interact with teachers and course materials. NLP technologies can enhance student learning through the creation of contextualised content, the provision of personalised feedback, and the creation of adaptive learning pathways. By analysing written and spoken language, NLP systems can identify students' strong and weak points, enabling teachers to target interventions and support in the most effective areas.

Additionally, administrative tasks like grading and assessment can be made simpler in educational settings by utilising NLP. Automated language processing tools free up teachers' time to focus on more individualised and interactive aspects of instruction by efficiently grading written assignments. Furthermore, NLP can be used to develop intelligent tutoring systems that adapt to the distinct learning styles, pacing, and preferences of each student, enhancing classroom dynamics and responsiveness.

Though there are still many important issues to address, such as data privacy, ethical concerns, and the need for ongoing research and development, NLP has a lot to offer in the area of education. To achieve the greatest impact possible, NLP must strike a balance between responsible application and technological innovation in order to fully influence the direction of education.

## 3.3 Professional competences

Professional competences are the abilities, know-how, and character attributes required to succeed in a particular role or area of the workforce. These extracurricular competences typically consist of practical knowledge, problem-solving skills, flexibility, and effective communication. Professional competences in a given field are developed via practical training, ongoing education, and exposure to real-world challenges. In order to make sure that their candidates can successfully navigate the complexities of their roles and contribute to the workplace, employers look for candidates who have a strong combination of academic and professional competences.

### 3.3.1 NLP in business communication

NLP offers a wide range of applications that improve efficacy, accuracy, and efficiency, making it an essential component of the transformation in business communication. A lot of unstructured data can be automatically processed with NLP. In domains like contract management, where it can save time and money on comparable tasks, NLP is especially helpful because it can analyse and extract important information from legal documents. As companies depend more and more on digital communication, NLP emerges as a potent tool for streamlining and enhancing business communication in a number of ways.

Data extraction and analysis are important additional uses. Large datasets can be sorted through by NLP algorithms, which can then extract important patterns and insights that would be too complex for humans to

analyse by hand. Maintaining an awareness of consumer preferences, industry trends, and competitor activity is a valuable skill for businesses, particularly when conducting market research.

Additionally, NLP helps to improve CRM (customer relationship management) systems. Businesses can better understand the needs and preferences of their customers by examining customer interactions, feedback, and communication channels. This helps with proactive problem solving and providing a more positive customer experience, in addition to supporting customised marketing strategies.

NLP is used in business intelligence to help extract useful information from textual data. Executives and decision-makers who can obtain condensed reports and analyses produced by NLP algorithms will find this to be extremely helpful. An essential component of today's hectic business climate is timely and well-informed decision-making, which is made possible by the automation of these processes.

### 3.4 HTML interface for competence matching

Below is a condensed example that makes use of JavaScript and basic HTML. This example is a simple demonstration for educational purposes and assumes some familiarity with web development and API integration.

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Competence Matcher</title>
  <style>
    /* Add your styles here */
  </style>
</head>
<body>

  <h1>Competence Matcher</h1>

  <!-- Form to enter competences -->
  <form id="competenceForm">
    <label for="competenceID">ID:</label>
    <input type="text" id="competenceID" required>
    <br>
    <label for="competenceTitle">Title:</label>
```

```

<input type="text" id="competenceTitle" required>
<br>
<label for="competenceDescription">Description:</label>
<textarea id="competenceDescription" required></textarea>
<br>
<button type="button" onclick="submitCompetence()">Submit</button>
</form>

<!-- Display area for similarity coefficients -->
<div id="similarityResults">
  <h2>Similarity Coefficients</h2>
  <ul id="coefficientsList"></ul>
</div>

<script>
function submitCompetence() {
  // Get values from the form
  const competenceID = document.getElementById("competenceID").value;
  const competenceTitle = document.getElementById("competenceTitle").value;
  const competenceDescription = document.getElementById("competenceDescription").value;
  // Validate that values are not empty
  if (!competenceID || !competenceTitle || !competenceDescription) {
    alert("Please fill in all fields.");
    return;
  }
  // Call ChatGPT API for similarity coefficient (dummy example)
  const dummyAPIResponse = {
    coefficients: [
      { id: 1, similarity: 0.75 },
      { id: 2, similarity: 0.60 },
      // Add more coefficients as needed
    ]
  };
  // Display similarity coefficients
  displaySimilarityCoefficients(dummyAPIResponse.coefficients);
}

function displaySimilarityCoefficients(coefficients) {
  // Clear previous results

```

```

document.getElementById("coefficientsList").innerHTML = "";
// Display new results
coefficients.forEach(item => {
  const listItem = document.createElement("li");
  listItem.textContent = `ID: ${item.id}, Similarity: ${item.similarity}`;
  document.getElementById("coefficientsList").appendChild(listItem);
});
}
</script>
</body>
</html>

```

### 3.5 Conclusion

A promising approach to improving talent acquisition and career development is the integration of NLP into the evaluation of academic and professional competences, in conjunction with the use of an HTML interface for competence matching. The NLP algorithms work well at deciphering and comprehending the complex language of professional credentials and academic accomplishments. This guarantees a more thorough evaluation that takes into account both academic excellence and practical skills, while also speeding up the candidate selection process.

The main goal of an HTML interface for competence matching is to create an approachable link between the professional and academic domains. Employers, recruiters, and educational institutions can use the visually intuitive platform it offers to match the desired competences with the wide range of professional experiences and academic accomplishments. By streamlining the assessment procedure, this interface promotes better decision-making and a closer fit between the demands of the industry and academic preparation.

One of the primary outcomes of this integration is a recruitment process that is more effective, with an emphasis on finding candidates whose academic competences are in alignment with the practical demands of the professional world. Additionally, it makes candidates' comprehensive skill sets more visible, closing the conventional gap between academic accomplishments and the changing demands of the labour market.

Future research in this area should focus on improving and extending NLP algorithms to suit a wider variety of scholarly and professional settings. Incorporating machine learning techniques for more precise matching and competence prediction based on current academic achievements can be explored further. The competence matching model will need to be continuously refined through industry and academic collaboration in order to remain relevant and effective in the quickly changing educational and professional landscape. The combination of NLP and HTML interfaces has the potential to fundamentally alter how academic and professional

competences are evaluated, matched, and used for both individual and organisational success as technology develops.

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## 7 . A6.4. 6. Implementation of User Client mockup (UoI)

In the pursuit of enhancing the user experience and accessibility of the comprehensive search engine project, the next steps focus on the implementation of User Client mockup. This pivotal chapter sets the stage for the exploration into the technical intricacies and collaborative efforts behind the development of the search engine. At its core, the User Client Mockup serves as the user-facing gateway to the search engine. It is a testament to the commitment to delivering an intuitive and efficient platform for users to discover courses, competences and



skills. The team's unique responsibility in this project centers around the development of a Python script that interfaces seamlessly with the search engine, and by extension, with the portal. This script is instrumental in providing users with tailored search results based on their queries.

The project draws its substance from a rich and diverse dataset encompassing universities, courses, competences, skills and a wealth of associated information. This dataset fuels the search engine's functionality and is a cornerstone of our project's success.

We recognize that the search engine's usability is of paramount importance. Its role extends beyond mere functionality; it is the conduit through which users access the educational resources they seek. The ease with which users navigate this interface directly impacts the efficacy of our entire project.

#### 4.1 Technologies and Frameworks

In the development of the search engine, various technologies and frameworks were utilized to build a responsive and efficient web application.

Considering the script, one of the first methods that was used was Flask. Flask is a lightweight web framework for Python. It provided the essential structure and tools needed to create the search engine. Flask is known for its simplicity and ease of use, making it an excellent choice for building web applications. It allowed the team to define routes, handle HTTP requests, and structure the web application with minimal overhead (Saini, 2021).

The Sentence Transformer model is a cutting-edge Natural Language Processing (NLP) model. It is designed to transform text into meaningful vector representations. It was used to calculate semantic similarity scores between user queries and course/competence descriptions. This technology enabled the team to deliver precise and relevant search results by understanding the meaning of text (Reimers, 2022).

Numpy is a powerful numerical computing library for Python. It excels in handling arrays and performing mathematical operations efficiently. In this implementation, Numpy was crucial for vector calculations, which helped determine the similarity between user queries and course/competence descriptions. Its efficiency ensured quick and accurate search results (w3schools, n.d.).

Pandas is a versatile data manipulation library for Python. It simplifies tasks related to data cleaning, transformation, and analysis. Pandas was used to handle the dataset, ensuring that it was properly formatted and ready for integration with the search engine. Pandas made it easy to manage and manipulate large volumes of data efficiently (w3schools, n.d.).

Flask-CORS is an extension for Flask that simplifies Cross-Origin Resource Sharing (CORS). It's essential when a web application needs to interact with external resources, like APIs, hosted on different domains. By implementing Flask-CORS, it was ensured that the search engine could seamlessly communicate with external resources without encountering browser restrictions (Lahoti, 2022).

Python served as the programming language for our entire project. It's known for its readability and versatility. Python's extensive ecosystem of libraries and frameworks made it an ideal choice. It provided the foundation for

the search engine's functionality, enabling the team to integrate various technologies and develop a robust web application.

These technologies collectively formed the backbone of the search engine, ensuring that it was responsive, efficient, and capable of delivering an exceptional user experience.

## 4.2 Backend Integration

In the development of the search engine, seamless integration with the back-end of the project was imperative. This chapter delves into the intricacies of how the Python script harmoniously interfaces with the search engine to provide users with tailored search results based on their queries.

The Python script plays a pivotal role in retrieving and processing data from the extensive dataset that our team was provided with. This dataset encompasses a wealth of information, including universities, courses, competences, skills and other relevant details. The script ensures that this data is readily available for search queries, contributing to the comprehensive nature of the search engine's offerings.

Before the data is integrated into the search engine, it undergoes a crucial preprocessing phase. This step is vital in maintaining data accuracy and consistency. Through the use of Python libraries such as Pandas, the data was cleaned, formatted, and transformed, ensuring that it is well-prepared for seamless integration.

The heart of the search engine's functionality lies in its ability to provide users with highly relevant course and competence recommendations, as well as relevant skills along with their description. This is made possible through the integration of the Sentence Transformer model. The Python script utilizes this model to calculate semantic similarity scores between user queries and database entries. These scores enable the team to offer users precise content recommendations that align with their interests and needs.

In addition, the Python script serves as the bridge between the back-end database and the search engine's front-end. It responds to user queries received through the search engine's interface, querying the database for relevant information, and processing the results. This interaction is seamless, ensuring that users receive prompt and accurate responses to their queries.

Overall, it is of high importance to explain the way that the Python script efficiently retrieves, processes, and delivers data to the search engine. This back-end integration ensures that the search engine operates as a cohesive and responsive interface, providing users with a seamless experience as they explore courses and competences.

## 4.3 Architecture

The architecture of this implementation serves as the backbone of the project, providing the structural framework that supports the seamless operation of the search engine tool. Below, the key components that constitute this architecture are presented, along with their roles, and the way they interact to deliver a robust and user-friendly solution.

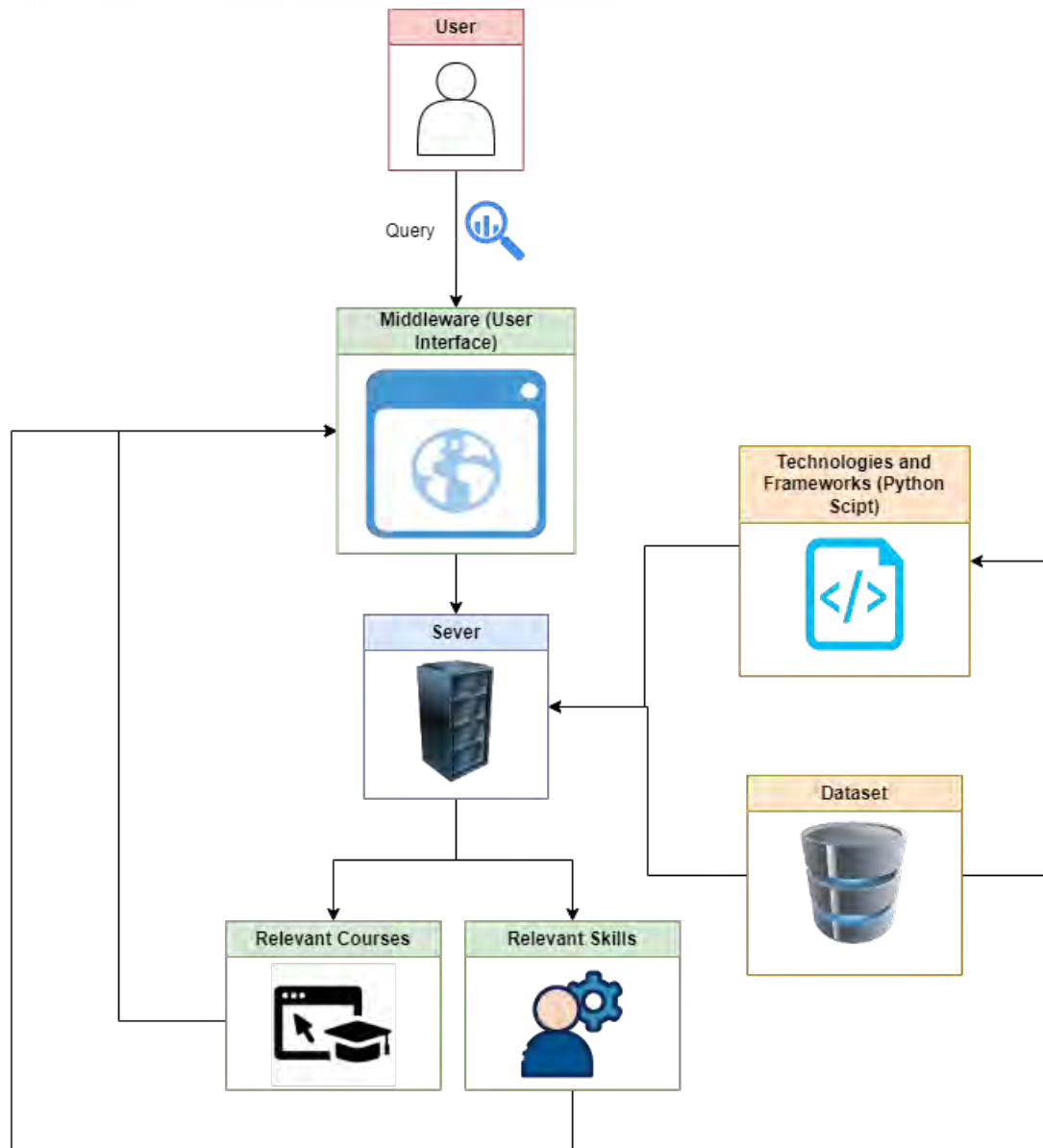
At the heart of our architecture, we find three fundamental components:

- **Server at the University of Ioannina:** This server serves as the nucleus of our project, housing the core functionalities of the search engine tool. It is here that the intricate algorithms, described in the “Technologies and Frameworks” chapter, come to life, processing user queries, and generating relevant course recommendations.
- **Dataset:** The dataset provided by our collaborators plays a pivotal role as the project's database. It encompasses essential data points such as university names, degree programs, academic levels, course listings, associated competencies, links as well as skills along with their description. This dataset forms the basis for our search engine's ability to retrieve and present relevant course information.
- **Middleware (User Interface):** The middleware, or user interface, is a vital component developed by the University of Ioannina. It serves as the user-facing aspect of our project, facilitating user interactions with the search engine tool. The middleware acts as a bridge between the server's algorithms and the end-users, providing a friendly and intuitive interface for conducting searches and accessing course information.

The synergy among these components is what empowers our project:

- **User Query Processing:** When a user submits a query via the middleware, it is relayed to the server. The server leverages its algorithmic capabilities to analyze the query and retrieve relevant courses and relevant skills from the dataset.
- **Data Retrieval:** The dataset, meticulously crafted by our collaborators, contains a wealth of information about courses, universities, degrees, competencies and skills. This data is tapped into to provide accurate and up-to-date course recommendations.
- **User Interface Integration:** The middleware transforms the server's responses into a user-friendly format, presenting course recommendations, university details, and competency information in an easily digestible manner.

To visually represent this architecture, the following diagram is presented:



**Figure 1: Architecture Diagram**

This diagram provides a holistic view of the components' interconnections and their roles in delivering a seamless user experience.

#### 4.4 Integration with the eMEDIATOR Portal

In this chapter, we delve into the seamless integration of our search tool into the eMEDIATOR portal, a collaborative effort that further extends the reach and impact of our educational solution.

Once our search engine was fully functional and equipped with the necessary technologies and dataset, it was poised for the next crucial step: integration into the eMEDIATOR portal. This integration was a collaborative endeavor, made possible through close cooperation with our esteemed partners from the German team.

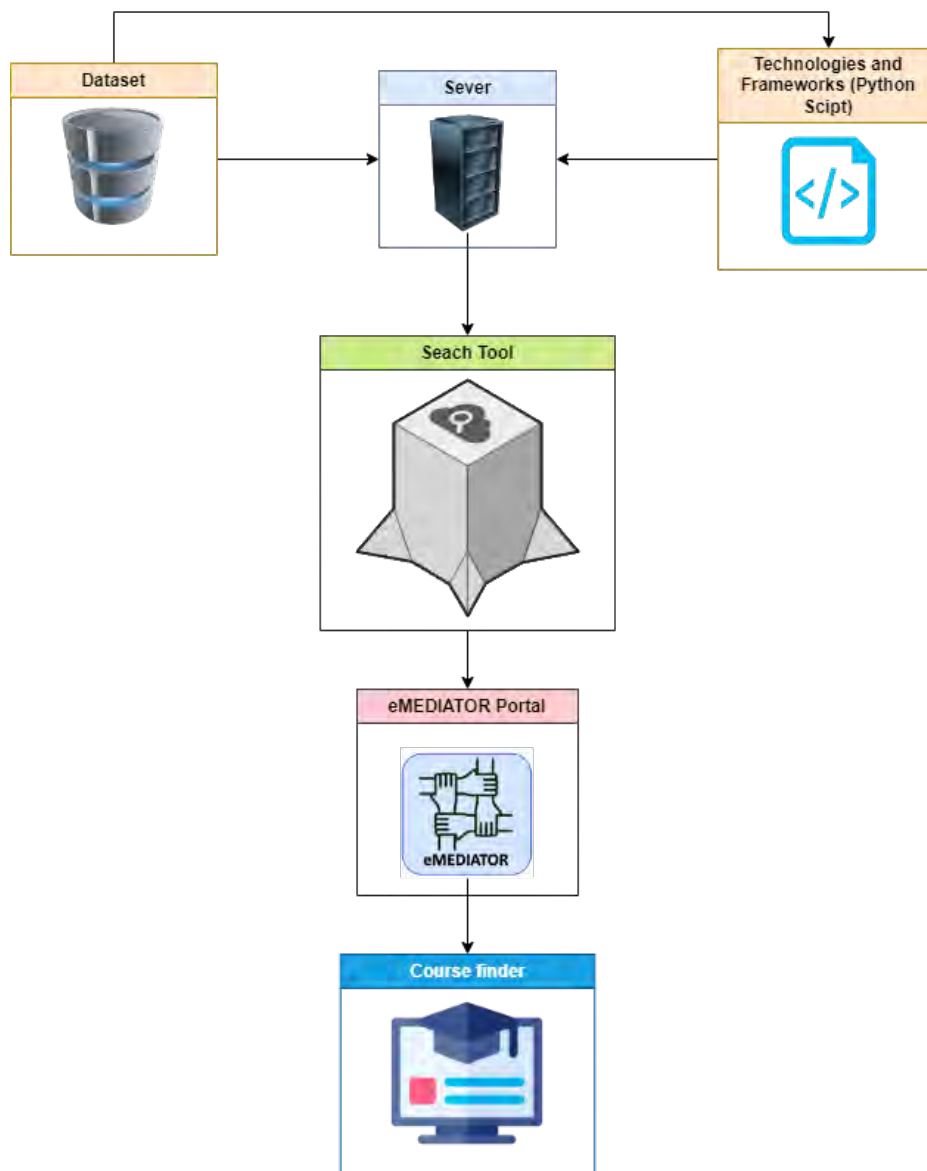
Our German collaborators played a pivotal role in this integration process. Their expertise in web development and platform integration ensured a smooth and effective merger of our search engine tool into the eMEDIATOR portal. Together, we aimed to provide users with a unified and comprehensive educational resource.

At the heart of this integration lies the "Course Finder," a dedicated section within the eMEDIATOR portal. The Course Finder leverages the capabilities of our search tool, offering users a powerful and user-friendly means to explore a world of educational opportunities. Users can access this feature seamlessly, thanks to the collaborative efforts of our teams.

Key highlights of this integration are:

- **Seamless User Experience:** The integration of our search engine into the eMEDIATOR portal ensures a seamless user experience. Users can easily navigate to the Course Finder section, eliminating the need for multiple platforms and simplifying the educational journey.
- **Rich Educational Resources:** Through the Course Finder, users gain access to a wealth of educational resources, including courses, competencies, universities, skills and more. Our extensive dataset powers this resource, enabling users to make informed decisions about their educational pursuits.
- **Personalization and Accessibility:** The integration allows for the personalization of educational pathways, as users can tailor their searches to match their unique interests and goals. Moreover, it promotes accessibility by providing a user-friendly interface that caters to learners of all backgrounds.
- **Collaborative Synergy:** The integration embodies the spirit of collaboration between our teams, exemplifying our commitment to working together to enhance educational accessibility and quality.





**Figure 2: Integration**

Beyond offering users access to relevant courses and competencies, the search tool also offers relevant skills. This enhancement allows users to not only discover courses aligned with their educational goals but also gain insights into the specific skills they can acquire. Each skill is accompanied by a detailed description, empowering users to make well-informed decisions about their educational journey. This evolution reflects partners' dedication to enhancing the user experience and equipping learners with the knowledge and competencies they need to thrive in an ever-evolving educational landscape.

Presented below is a mockup according to this functionality and the architecture of the search tool.

## eMEDIATOR Search Tool

Log out

Relevant Courses					
University	Degree	Level	Course	Description	Link

Relevant Skills	
Skill	Description

**Figure 3: Mockup**

The successful integration of our search tool into the eMEDIATOR portal represents a significant achievement in our journey to redefine education. It signifies the creation of a unified educational ecosystem, where learners can explore, discover, and embark on their educational paths with ease and confidence.

#### 4.5 Integration phase with Moodle

The seamless integration of Moodle within the eMEDIATOR platform represents a significant stride toward enriching the educational landscape and expanding the horizons of learning opportunities. This chapter narrates the story of how collaborative efforts have culminated in the integration of multiple Moodle instances, each contributing to a diverse and comprehensive educational repository.

A fundamental aspect of this endeavor is to provide learners with access to a wide spectrum of educational offerings. To fulfill this vision, esteemed partners have established their own Moodle instance, thoughtfully curating a repository of courses to cater to the diverse needs and aspirations of learners.

The integration of Moodle instances augments the eMEDIATOR ecosystem by incorporating a repository of courses meticulously assembled by partners. These courses span a multitude of subjects and disciplines, presenting users with an extensive selection to explore and select from.

The User Client Mockup search engine, seamlessly integrated into the eMEDIATOR portal, now leverages the abundance of courses available within this Moodle instance. As users embark on their educational journeys and

employ the search tool, they are presented with offerings from the integrated Moodle repository. This unified search experience simplifies the educational pathway and amplifies the scope of choices accessible to learners.

The University of Ioannina has imported the course of cybersecurity to this integrated Moodle repository. Initially hosted on a separate Moodle instance, this course now finds its place within the eMEDIATOR platform. The importation and sharing of expertise in this critical field aims to empower learners with essential cybersecurity knowledge and skills, fostering a safer digital landscape for all.

## 4.6 Registration

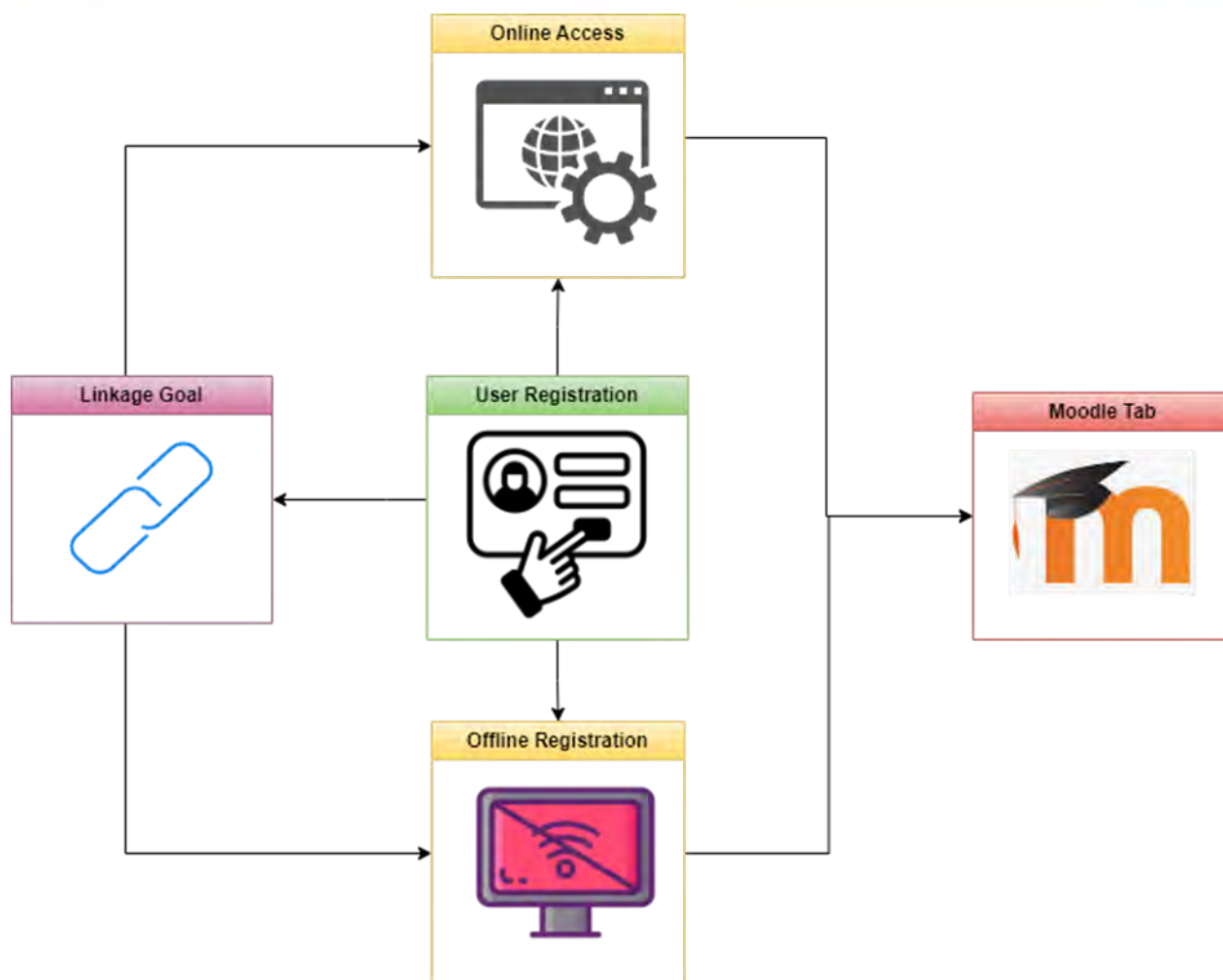
The eMEDIATOR website extends an open invitation to learners, educators, and knowledge seekers, welcoming them to become an integral part of our educational community. In this chapter, we explore the registration process, both online and offline, that grants users access to a world of knowledge and learning opportunities.

Online registration is the key to unlocking the full potential of the eMEDIATOR website. It is a simple yet transformative process that empowers individuals to explore a diverse array of educational resources. By registering on the platform, users gain access to a wealth of courses, competencies, and invaluable learning materials.

Upon successful registration, a significant transformation occurs. The Moodle tab, a gateway to educational courses hosted on the integrated Moodle instance, becomes accessible. This integration ensures a seamless transition between the eMEDIATOR portal and the Moodle environment, providing a unified and uninterrupted learning experience.

Recognizing the importance of inclusivity, our commitment extends beyond online registration. We have implemented an offline registration mechanism, ensuring that individuals without reliable internet access can still participate in our educational ecosystem. Offline registration centers, equipped with the necessary resources, offer individuals the opportunity to join our community, bridging the digital divide that often hinders access to quality education.

One of our primary objectives is to create a cohesive and holistic educational experience. To this end, we have undertaken the goal of linking the registration process of the eMEDIATOR portal with that of the Moodle environment. This linkage ensures that learners seamlessly transition between these two platforms, eliminating redundancy in registration and offering a more streamlined educational journey.



**Figure 4: Registration Process**

The registration process represents more than just a point of entry; it symbolizes empowerment. It empowers individuals to explore, learn, and grow within a community that values education as a catalyst for personal and societal progress.

#### 4.7 Conclusion

Throughout this implementation process, several notable achievements have come to fruition. eMEDIATOR website is meticulously crafted to provide a responsive and intuitive interface, with the search engine to seamlessly interface with the extensive dataset, delivering tailored course and skill recommendations to users. The Python script, a crucial component of the back-end, ensures the efficient retrieval and processing of data, enabling quick and accurate search results. Robust security measures are in place to protect user data and privacy, and comprehensive user training and support resources have been provided to empower users to explore and engage with the portal.

The journey of implementing the User Client Mockup has offered valuable insights into the significance of user-centered design, technological innovation, and the role of data in enhancing user experiences. The potential of

NLP models, like Sentence Transformer, in delivering highly relevant recommendations and the importance of secure data handling in maintaining user trust were witnessed.

In the coming phases, some envisions are:

- **User Testing and Feedback:** Gathering user feedback to refine and enhance our User Client's usability, features, and performance.
- **Scalability:** Preparing the portal for future growth, accommodating an ever-expanding array of courses and competences.
- **Advanced Personalization:** Implementing advanced personalization features and machine learning algorithms to provide even more tailored recommendations.
- **Partnerships and Collaborations:** Exploring opportunities to collaborate with educational institutions and organizations to expand the reach and impact of our portal.

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## 8 . A6.4. Extra 7. Development of AI embedding in the portal technology and architecture (UoI)

In the ever-evolving landscape of digital education, this chapter serves as the foundation for our exploration into AI embedding and MOOC (Massive Open Online Course) architecture integration. The primary objectives in this



deliverable are to enhance user engagement, personalize learning experiences, and optimize educational processes.

This deliverable centers on key objectives:

- **Enhanced User Engagement:** The aim is to captivate and engage users on a deeper level through AI embedding and MOOC integration.
- **Personalization and Accessibility:** We seek to make learning more accessible by utilizing AI to provide tailored content and experiences.
- **Efficiency and Automation:** A practical project showcased here automates the transfer of answers from a questionnaire to course descriptions in our test Moodle, streamlining administrative tasks and improving content quality.

AI embedding augments the platform by facilitating more meaningful user interactions, personalized recommendations, and content curation. It also empowers us to offer personalized learning pathways and real-time progress insights.

The integration of MOOC architecture extends the platform's capabilities, providing users with access to a diverse range of courses and aligning with our mission to democratize education.

Embedded within this introduction is a project demonstrating the practical application of technology. This project automates the transformation of answers from a multiple-choice questionnaire into course descriptions in our test Moodle, streamlining administrative processes and enhancing content quality.

## 4.1 AI Embedding

In the realm of digital education, the incorporation of Artificial Intelligence (AI) stands as a pivotal advancement. This chapter delves into the fundamental aspects of AI embedding within our educational platform, emphasizing its significance and practical implications.

The utilization of AI technologies forms the bedrock of our platform's evolution. These technologies encompass:

- **Natural Language Processing (NLP):** NLP models can enable the portal to understand and process human language, facilitating seamless interactions between users and the system.
- **Machine Learning:** Machine learning algorithms drive the personalization of content and user experiences. They analyze user behavior and preferences to offer tailored course recommendations and optimize the learning journey.
- **Content Enhancement:** AI plays a vital role in improving educational content. It assists in curating relevant resources, automating content creation, and providing real-time analytics to assess the effectiveness of educational materials.

The integration of AI enriches user interactions in several ways:

- **Personalization:** AI-driven algorithms customize the user experience by tailoring course recommendations based on individual preferences and past interactions.

- **Responsive Chatbots:** Chatbots powered by AI enhance user support, providing instant responses to inquiries and facilitating smoother user interactions.
- **Content Analysis:** AI algorithms analyze content to ensure relevance and effectiveness, optimizing the learning process.
- **Real-time Insights:** Users benefit from real-time insights into their learning progress, allowing for informed decision-making and goal tracking.

The integration of AI is a catalyst for the portal's evolution, enhancing user engagement, personalization, and learning outcomes. It underscores our commitment to leveraging technology to provide accessible and efficient educational resources.

## 4.2 MOOC Integration

Within the landscape of modern education, the seamless integration of Massive Open Online Courses (MOOCs) stands as a pivotal milestone. This chapter explores the strategic incorporation of MOOC architecture into our educational platform, emphasizing its significance and practical implications.

The decision to integrate MOOCs into our platform is rooted in several compelling reasons:

- **Diverse Learning Opportunities:** MOOCs offer a vast array of courses spanning various subjects, ensuring that learners have access to a diverse range of educational content.
- **Scalability:** MOOCs are renowned for their scalability, accommodating large numbers of users without compromising the quality of the learning experience.
- **Accessibility:** The flexibility of MOOCs enables users to learn at their own pace, breaking down geographical barriers and making education accessible to a global audience.

The integration of MOOCs involves a meticulous approach to ensure seamless operation:

- **Platform Compatibility:** MOOCs from various providers need to integrate seamlessly within our platform, ensuring that users can navigate through them effortlessly.
- **Data Synchronization:** Regular data synchronization with MOOC providers ensures that our users have access to up-to-date course offerings and materials.
- **Content Delivery:** Users should be able to access MOOC content directly through our platform, simplifying the learning process and eliminating the need for multiple logins or external platforms.

Central to MOOC integration is the user experience and accessibility:

- **Unified User Interface:** Users should encounter a consistent user interface when accessing MOOCs within our platform, promoting ease of use and familiarity.
- **User Registration:** Registration for MOOCs should be a seamless process, minimizing any barriers that may discourage users from exploring these valuable resources.

- **Tracking Progress:** Our platform should enable users to track their progress within MOOCs, providing a comprehensive view of their educational journey.

MOOC integration expands the horizons of our educational platform, offering users a broader spectrum of learning opportunities and experiences. It aligns with our mission to democratize education, ensuring that high-quality content is accessible to a global audience.

### 4.3 Content Enhancements

In the relentless pursuit of elevating the educational experience, this chapter navigates through the pivotal realm of content enhancements within our portal. We delve into the strategic role of Artificial Intelligence (AI) in augmenting educational materials, fostering personalization, and optimizing learning outcomes.

AI's transformative influence extends to various facets of educational content:

- **Content Curation:** AI algorithms assist in curating and recommending relevant resources. This ensures that users are exposed to content aligned with their interests, making their learning journeys more engaging and effective.
- **Personalized Learning Pathways:** AI analyzes user behavior and preferences to craft personalized learning pathways. Each user's educational journey becomes unique, aligning with their goals and aptitudes.
- **Automation of Content Creation:** AI-driven tools automate the creation of educational content. This streamlines the process of generating materials, reducing the workload on educators and administrators.
- **Real-time Analytics:** AI provides real-time analytics on content effectiveness. Educators gain insights into how learners interact with materials, enabling them to make data-informed adjustments for improved learning outcomes.

The integration of AI is a catalyst for improving the overall learning experience:

- **Engagement:** Personalized content and pathways captivate learners, enhancing their motivation and engagement with educational materials.
- **Efficiency:** Automation and analytics tools streamline administrative tasks and content creation, making the educational process more efficient for both educators and learners.
- **Effectiveness:** AI-driven insights and recommendations optimize the effectiveness of educational content, fostering better comprehension and retention.
- **Progress Tracking:** Real-time tracking of progress empowers learners to take control of their educational journeys, providing them with a sense of accomplishment and direction.

The strategic implementation of AI in content enhancements underscores our commitment to providing accessible, engaging, and effective educational resources. This chapter lays the foundation for a deeper

exploration of AI's role in shaping the content landscape within our portal, emphasizing its potential to revolutionize the learning experience.

#### 4.4 Project Showcase: Automating Course Descriptions

In this chapter, we turn our attention to a practical project. The project showcased here revolves around the automation of course descriptions, a transformative initiative that streamlines administrative processes, enhances content quality, and contributes to a more informed and engaging learning environment.

The automation project featured in this chapter represents a pivotal step in our journey to harness technology for the benefit of our users. At its core, this project focuses on the seamless transformation of answers obtained from a multiple-choice questionnaire into comprehensive course descriptions within our test Moodle environment.

A successful execution of the project required meticulous technical planning and implementation:

- **Data Collection:** The project begins with the collection of user responses from a multiple-choice questionnaire in LimeSurvey. These responses serve as the foundation for course descriptions.

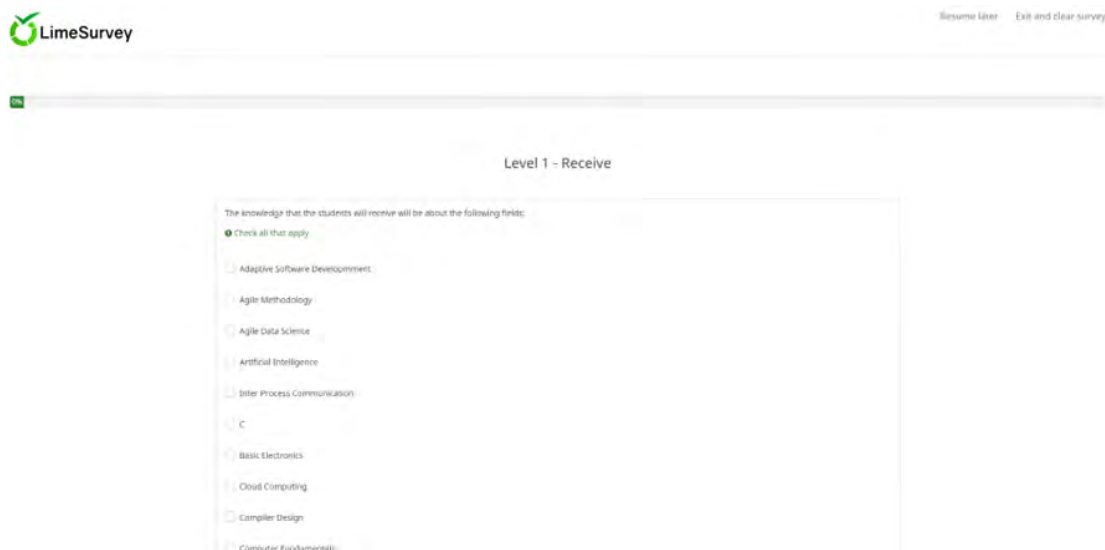
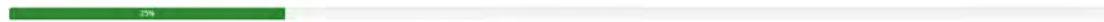


Figure 1: Questionnaire - Level 1



[Resume later](#) [Exit and clear survey](#)



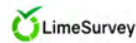
### Level 2 - Reproduce

The course will instill and transmit specific knowledge about the following fields:

• Check all that apply

- ☐ Adaptive Software Development
- ☐ Agile Methodology
- ☐ Agile Data Science
- ☐ Artificial Intelligence
- ☐ Inter Process Communication
- ☐ C
- ☐ Basic Electronics
- ☐ Cloud Computing
- ☐ Compiler Design
- ☐ Computer Fundamentals

Figure 2: Questionnaire - Level 2



[Resume later](#) [Exit and clear survey](#)



### Level 3 - Produce/Create

The students will be able to develop the necessary skills for analysing, repairing and synthesising knowledge about the following areas:

• Check all that apply

- ☐ Adaptive Software Development
- ☐ Agile Methodology
- ☐ Agile Data Science
- ☐ Artificial Intelligence
- ☐ Inter Process Communication
- ☐ C
- ☐ Basic Electronics
- ☐ Cloud Computing
- ☐ Compiler Design
- ☐ Computer Fundamentals

Figure 3: Questionnaire - Level 3





#### Level 4 - Self-Management

The students will be able to evaluate and assess their understanding about the following subjects:

☒ Check all that apply

☐ Adaptive Software Development

☒ Agile Methodology

☐ Agile Data Science

☐ Artificial Intelligence

☐ Inter Process Communication

☐ C

☐ Basic Electronics

☐ Cloud Computing

☐ Compiler Design

☐ Computer Fundamentals

Figure 4: Questionnaire - Level 4

- **Data Transformation:** Scripting and programming, utilizing Python and other tools, facilitate the transformation of raw questionnaire data into descriptive course content. The answers from the questionnaire were downloaded in CSV format, and then modified to a json file.

```
{
  {
    "The knowledge that the students will receive will be about the following fields: [Agile Methodology]": "Yes",
    "The knowledge that the students will receive will be about the following fields: [C]": "Yes",
    "The knowledge that the students will receive will be about the following fields: [Computer Fundamentals]": "Yes",
    "The knowledge that the students will receive will be about the following fields: [Digital Circuits]": "Yes",
    "The knowledge that the students will receive will be about the following fields: [Security and Cyber Law]": "Yes",
    "The knowledge that the students will receive will be about the following fields: [UML]": "Yes",
    "The knowledge that the students will receive will be about the following fields: [SOA (Service Oriented Architecture)]": "Yes",
    "The students will receive in depth knowledge and foundation within the specific fields: [Agile Data Science]": "Yes",
    "The students will receive in depth knowledge and foundation within the specific fields: [Compiler Design]": "Yes",
    "The students will receive in depth knowledge and foundation within the specific fields: [Graph Theory]": "Yes",
    "The students will receive in depth knowledge and foundation within the specific fields: [Operating systems]": "Yes",
    "The students will receive in depth knowledge and foundation within the specific fields: [Standard Operating Systems Functional Components ]": "Yes",
    "The students will receive in depth knowledge and foundation within the specific fields: [Object-Oriented Paradigm]": "Yes",
    "The course will instantiate and transit specific knowledge about the following fields: [Artificial Intelligence]": "Yes",
    "The course will instantiate and transit specific knowledge about the following fields: [Data Communication]": "Yes",
    "The course will instantiate and transit specific knowledge about the following fields: [Embedded Systems]": "Yes",
    "The course will instantiate and transit specific knowledge about the following fields: [AR/VR]": "Yes",
    "The course will instantiate and transit specific knowledge about the following fields: [UML]": "Yes",
    "The course will instantiate and transit specific knowledge about the following fields: [Microprocessors]": "Yes",
    "The students will be able to translate ideas about: [Cloud Computing]": "Yes",
    "The students will be able to translate ideas about: [Data Mining]": "Yes",
    "The students will be able to translate ideas about: [Data Warehouse]": "Yes",
    "The students will be able to translate ideas about: [Functional Programming]": "Yes",
    "The knowledge to be transposed and applied through this course is relevant to the following fields: [Cryptography]": "Yes",
    "The knowledge to be transposed and applied through this course is relevant to the following fields: [Design and Analysis of Algorithms]": "Yes",
    "The knowledge to be transposed and applied through this course is relevant to the following fields: [DBMS (Database Management System)]": "Yes",
    "The knowledge to be transposed and applied through this course is relevant to the following fields: [Security and Cyber Law]": "Yes",
    "The knowledge to be transposed and applied through this course is relevant to the following fields: [Internet of Things (IoT)]": "Yes",
    "The students will be able to develop the necessary skills for analyzing, repairing and synthesizing knowledge about the following areas: [Agile Data Science]": "Yes",
    "The students will be able to develop the necessary skills for analyzing, repairing and synthesizing knowledge about the following areas: [Computer Fundamentals]": "Yes",
    "The students will be able to develop the necessary skills for analyzing, repairing and synthesizing knowledge about the following areas: [Digital Circuits]": "Yes",
    "The students will be able to develop the necessary skills for analyzing, repairing and synthesizing knowledge about the following areas: [E-Commerce]": "Yes",
    "The students will be able to develop the necessary skills for analyzing, repairing and synthesizing knowledge about the following areas: [HTTP]": "Yes",
    "The students will be able to develop the necessary skills for analyzing, repairing and synthesizing knowledge about the following areas: [IPv4]": "Yes",
    "The students will be able to develop the necessary skills for analyzing, repairing and synthesizing knowledge about the following areas: [IPv6]": "Yes",
    "The students will be able to develop the necessary skills for analyzing, repairing and synthesizing knowledge about the following areas: [Matlab]": "Yes",
    "The students will be able to evaluate and assess their understanding about the following subjects: [Discrete Mathematics]": "Yes",
    "The students will be able to evaluate and assess their understanding about the following subjects: [Mobile Computing]": "Yes",
    "The students will be able to evaluate and assess their understanding about the following subjects: [Standard Operating Systems Functional Components ]": "Yes",
    "The students will be able to evaluate and assess their understanding about the following subjects: [SOA (Service Oriented Architecture)]": "Yes",
    "The students will be able to evaluate and assess their understanding about the following subjects: [Object-Oriented Paradigm]": "Yes",
    "The students will be able to evaluate and assess their understanding about the following subjects: [UDDI (Universal Description, Discovery, and Integration)]": "Yes"
  }
}
```

Figure 5: Questionnaire's answers in json format

- **Moodle Integration:** With a connection to the Moodle database, the json file with the answers was transformed into the description of the selected course. The automated content is seamlessly integrated into our test Moodle, ensuring that it is accessible to users as part of course materials.

id	category	sortorder	fullname	shortname	idnumber	summary	summaryformat	format	showgrades	newsitems	startdate	enddate	marker	maxbytes	legacyfiles	showreports	visible
1	0	1	eMEDIATOR test	eMEDIATOR test				0 site	1	3	0	0	0	0	0	0	1
4	1	10001	Matlab	Matlab				1 topics	1	5	1691096400	1722632400	0	0	0	0	1
3	1	10002	Cyber Security	Cyber Security		Agile Methodology, C, Computer Fundamentals, Digit...		1 topics	1	5	1690923600	1722459600	0	0	0	0	1
2	1	10003	Java	Java		C, Cloud Computing, HTTP, Internet of Things (IoT)...		1 topics	1	5	1690405200	1721941200	0	0	0	0	1

Figure 6: Moodle Database

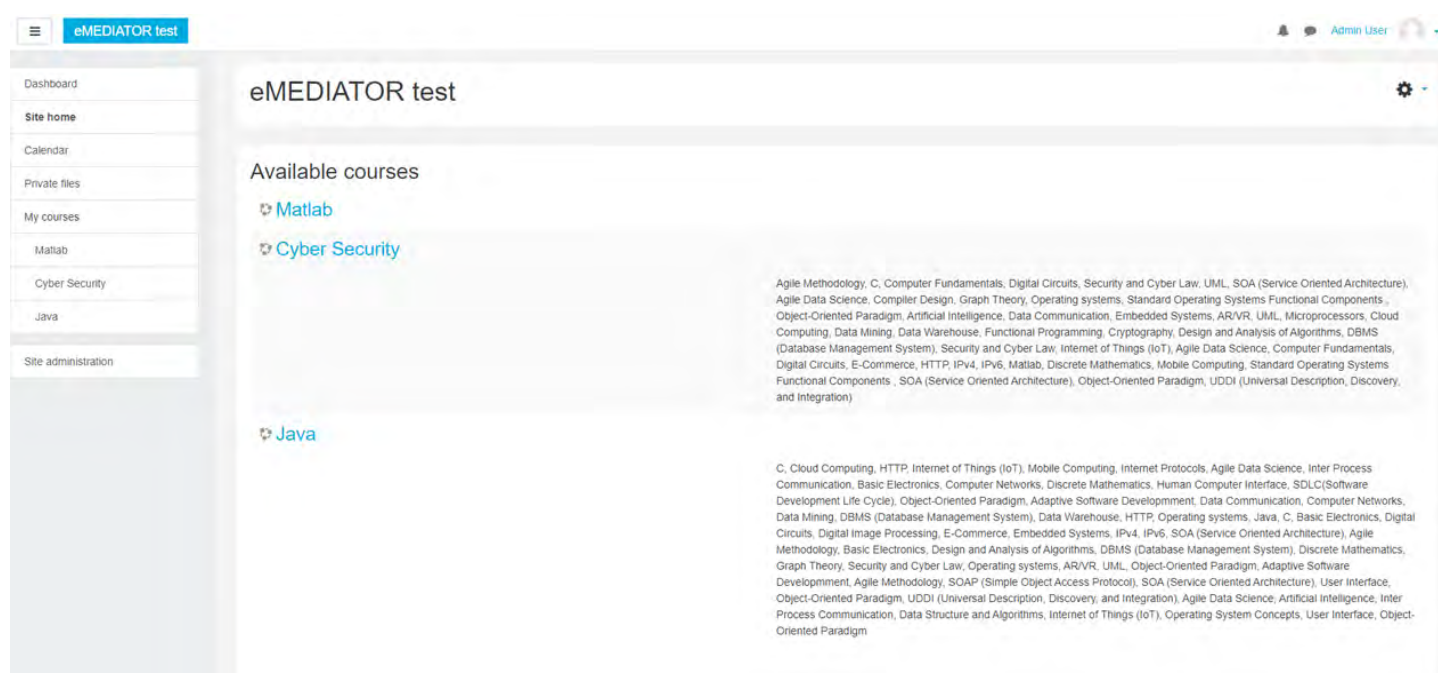


Figure 7: Course's description automatically integrated to Moodle

- **Quality Control:** Robust quality control mechanisms are in place to ensure the accuracy and relevance of automated course descriptions.

The project's impact extends to our users and the broader educational ecosystem:

- **Enhanced Course Descriptions:** Automated course descriptions provide users with more informative, engaging, and relevant insights into course content.
- **Streamlined Administrative Processes:** Automation reduces the workload on educators and administrators, allowing them to focus on higher-value tasks.
- **Integrated Learning Experience:** The automated content seamlessly integrates with our educational platform, contributing to a more cohesive and engaging learning experience.

The automation of course descriptions showcased in this chapter exemplifies our commitment to innovation and user-centered design. It underscores our dedication to leveraging technology to enhance the educational

experience, save time, and improve content quality. This project, integrated within our main narrative, symbolizes our mission to redefine education through the strategic fusion of technology and pedagogy.

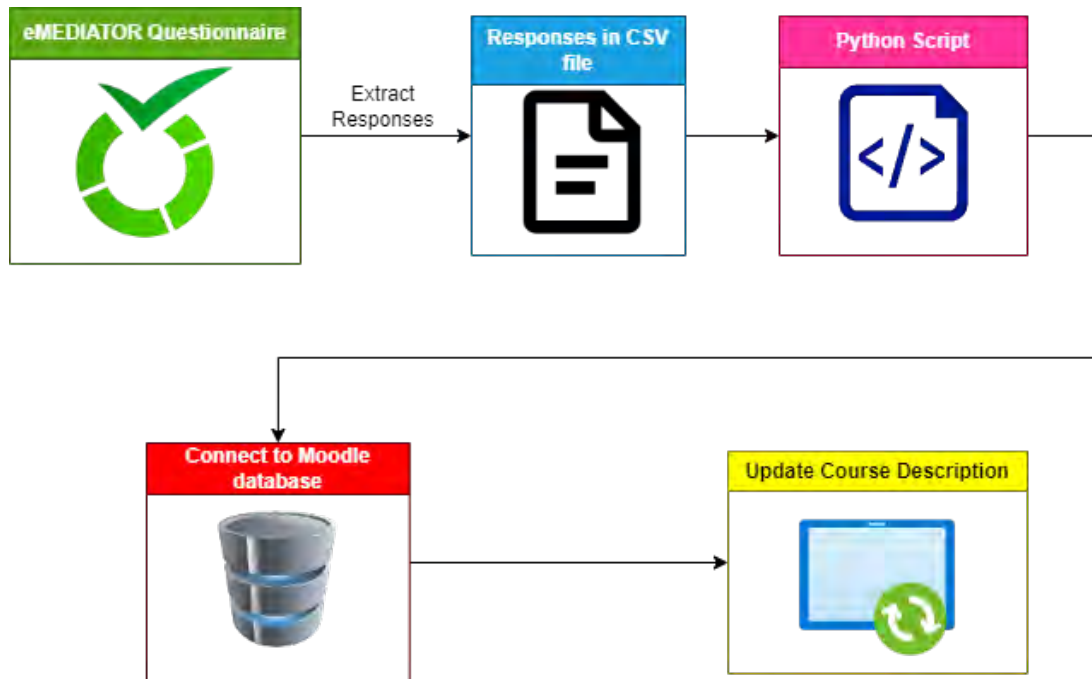


Figure 8: Methodology

## 4.5 Conclusion

In the culmination of our exploration into the realms of AI embedding, MOOC integration, content enhancements, and transformative projects, we arrive at the juncture of reflection and celebration. This chapter serves as a beacon, illuminating the key achievements, profound insights, and visionary aspirations that define our educational journey.

Our journey has been marked by several notable achievements:

- **Enhanced User Engagement:** Through AI embedding, we plan to achieve a deeper level of user engagement, personalizing learning experiences and fostering user motivation.
- **Access to Diverse Learning:** The seamless integration of MOOC architecture will open doors to a world of diverse learning opportunities, breaking down geographical barriers.
- **Optimized Content:** AI-driven content enhancements will improve content quality, relevance, and engagement, enriching the learning journey.
- **Automation for Efficiency:** The showcased project automating course descriptions exemplifies our commitment to efficiency and user-centric design, streamlining administrative tasks and enhancing content quality.



In addition, some profound insights are:

- **User-Centered Design:** Prioritizing the user experience and personalization is fundamental to educational success.
- **Technology as an Enabler:** Technology, when strategically integrated, can transform education, making it more accessible, engaging, and efficient.
- **Scalability for Growth:** Preparing for scalability is vital to accommodating a growing user base and expanding educational horizons.

In conclusion, our vision extends to the future:

- **Continued Innovation:** We are committed to continuous innovation, seeking new ways to enhance educational accessibility, quality, and efficiency.
- **Collaborations:** Collaborations and partnerships will remain at the forefront of our strategy, enriching our educational ecosystem.
- **User-Centric Approach:** The unwavering dedication to a user-centric approach will guide us as we navigate future challenges and opportunities.

This chapter encapsulates the essence of our educational journey, marking a significant milestone while propelling us toward an ever-brighter future. Our mission remains steadfast: to redefine education, making it accessible to all and fostering a lifelong love of learning.

## 4.6 Next Steps

With the echoes of our achievements resonating in the previous chapters, this final chapter charts the course for the steps that lie beyond. The deliverable's completion is not an endpoint but a stepping stone toward an even more transformative and accessible educational future.

The deliverable sets in motion a series of post-deliverable actions:

- **User Testing and Feedback:** Rigorous user testing will provide insights for iterative improvements, ensuring that our platform remains user-centric.
- **Iterative Enhancements:** We will continue to iterate on our AI embedding, MOOC integration, and content enhancements, refining our educational offerings.
- **Collaboration Opportunities:** We invite collaboration opportunities with educational institutions, content creators, and technology partners to enrich our educational ecosystem.

Furthermore, there are boundless opportunities for AI-driven enhancements within our portal:

- **Advanced Chatbots:** We envision the integration of advanced chatbots that can provide even more personalized and responsive support to users.
- **Virtual Tutors:** Virtual tutors powered by AI may become a reality, offering personalized guidance and support to learners.
- **Predictive Analytics:** The platform's AI capabilities could evolve to provide predictive analytics, helping learners make informed decisions about their educational journeys.

## LIST OF AUTHORS

1. Vasiliki Liagkou
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## 9 . A6.5.6. Formation of conclusions and recommendations for the further development of the portal. (AU)

After the first tests with the partners, we decided to change the framework from Liferay to WordPress to gain a more lightweight and easier to adjust landing page. WordPress was also easier than Liferay to customize the appearance since the available free templates for the page were easy to integrate and customizable.

After the second testing period with the partners on the new site, we added OAuth2, to include already existing Google accounts from each user. Here it is also possible, to add existing accounts from the universities, if they have OAuth2 enables for their account management system. If this could be realized, it is also possible to grant a user automatically the course creator role. As for the Aalen university of applied science, there is no OAuth2 due to security issues. Also, linking the accounts from bookscience could be implemented.

Linking the courses to a specific colour (as described in the previous section) was also a point to get a better overview of all the courses. This needs to be expanded, since the users can directly link a course to a specific topic. For now, every course is held in English, it might happen that some courses will be in another language. The coloured logos needs to be linked to the language by putting in a little flag to display it.

eMediator needs more tutorials, guidelines and how-tos, to ensure that every course goals are linked to the Blooms taxonomy, that every teacher and student are guided through the usage of Moodle and that every course is of high quality.



To measure the success of eMediator, automated calculations of the KPIs needs to be included. These KPIs can be:

- Tracking user behaviour over time
- Drop out rate
- How many courses did someone take and did he pass?
  - Course/pass rate (linked to a course)
  - Courses/pass rate (linked to a user)
- Ratio between signed and active user
- Success rate of courses based on topics
- Etc.

Further development for eMediator also includes the reliability and stability of the platform during peak usage times. This can be handled via server clustering and queuing.

To increase the usability for the teachers, it is also possible to create plugins in the future for Moodle and the learning platform for every university (like eclass, canvas, etc.). This plugin will be able to get the course from the teacher from his university and will upload all the course material to eMediator.

## LIST OF AUTHORS

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## 10. A6.5. Extra 7. Design of GUI (Graphical User Interface) for DEMO Application (AU)

This section describes the GUI and the website of the eMEDIATOR DEMO application.

### 5.1 General

The purpose of the eMediator is the following:

1. Landing page with explanation about the project
2. Learning platform
  - a. Usable as a student (enlist in courses)
  - b. Usable as a teacher (course creator)
3. Connecting jobs/research projects with interested people (provided by bookascience<sup>1</sup>)

<sup>1</sup> <https://bookascience.com/>

The landing page should have a responsive design, meaning, that it should have an adjustable design to be viewable from a computer, a tablet or a smartphone.

The address of the site is [www.emediator.org](http://www.emediator.org), the e-mail for the admin is [support@emediator.org](mailto:support@emediator.org).

The admin login credentials will be in a separate file.

## 5.2 Old Version

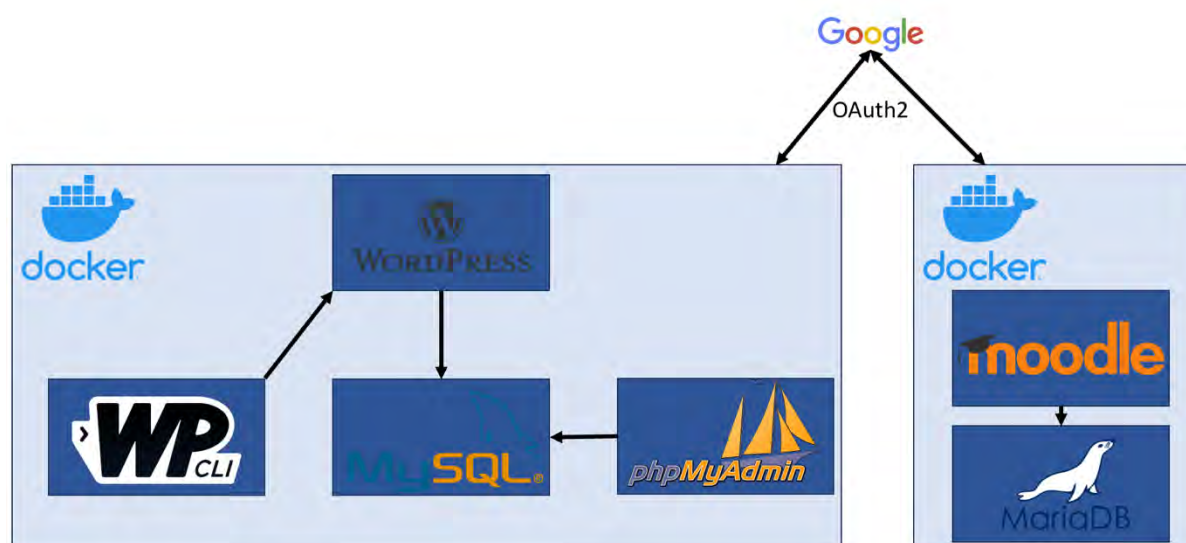
The old website version of eMediator was created with Liferay Portal<sup>2</sup>, but was cancelled due to the fact, that Liferay Portal is providing way more functionality, that was actually used by this project. It was decided to switch to WordPress, because WordPress is built modularly, meaning, that we can provide a more lightweight landing page for the users.

## 5.3 Architecture and general overview

The eMediator demo site is developed with two separate docker containers. First for the main page by using WordPress for the landing page and secondly Moodle for the learning platform.

Docker is used for an easier administration, updating and easy backup generation by tacking snapshots of the current docker container.

The docker-compose files are in the appendix.



**Figure 9 Architecture**

The WordPress container is also using:

- WordPressCLI, a terminal to handle Wordpress
- MySQL, database for store the information on the website
- phpMyAdmin, to handle MySQL

The Moodle container is using MariaDB as a database.

<sup>2</sup> <https://www.liferay.com/>

Both containers are using different databases for safety issues, since the course material on Moodle is only accessible after login to the Moodle site, whereas on the WordPress site most information is visible for everyone without an account to generate knowledge about the project.

### 5.3 Wordpress

WordPress<sup>3</sup> is a web content management system to create websites. It is also free and open-source. In this project it was used to create a lightweight landing page and an easy usability for the user. If there was missing functionality, a plugin can be installed due to its huge community.

Following tools/tasks must be provided by the landing page:

- Information about the project
- Information about the partners
- Course finder
- User management
- Links to bookascience and Moodle
- Board for user input and discussion
- Contact formular
- Privacy policy

### 5.4 Moodle

Moodle is a free and open-source learning platform. There are also other platforms used by the partners like Canvas, eclass, sakai etc..

Since every partner also used/uses or has experience with Moodle, we decided to use Moodle to provide the courses for the users.

Following tools/tasks must be provided by the learning platform:

- User management
- Role management
- Create courses
- Storage (e.g. .pdf, .docx., etc.)

### 5.5 OAuth2

OAuth2 is a method, to provide an easy and secure way to grant login to a webpage with an already existing account on another page. The WordPress and Moodle application are both working with the OAuth2 method in combination with Google.

---

<sup>3</sup> <https://wordpress.com/>

If a user already has a google account, he can use it to login to both sites without making a new account specific for this site. The user doesn't need to save or know a new user and password, he can use an already existing one.

In addition, it increases the data safety for eMediator. Since eMediator does not need to save the user credentials if the user decides to use his Google credentials. The credentials provider (in this case Google) saves all the necessary credentials from the user and grants access to the eMediator pages after an authorization handshake (see figure 2

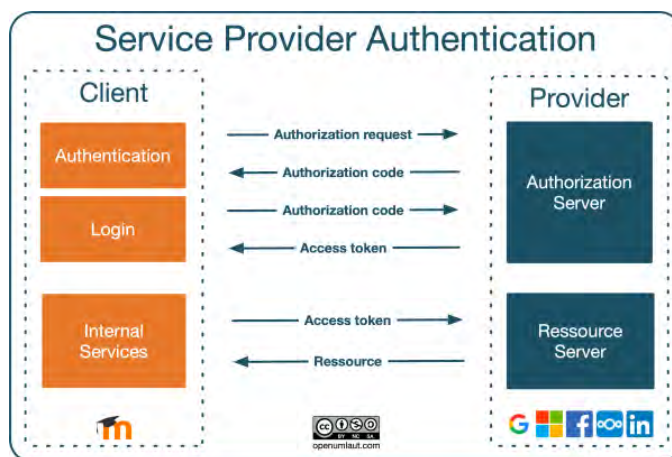


Figure 10 OAuth2 - Moodle and Google<sup>4</sup>

## 5.6 Website Structure

There are two versions of the header. The first one is for not logged in users, the second one is for logged in users.

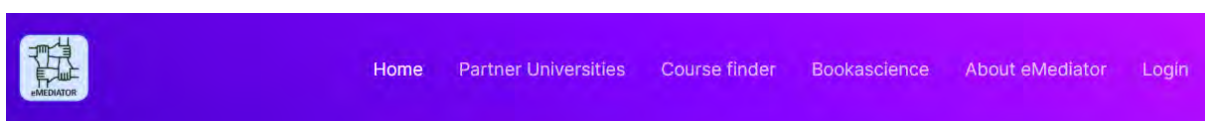


Figure 11 Header - Not logged in user

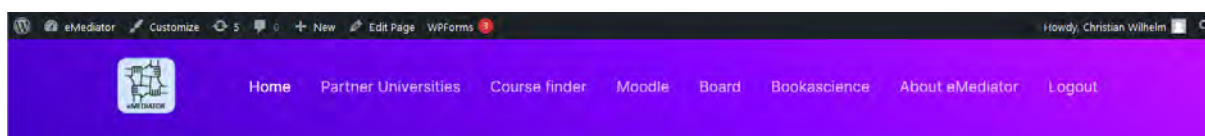


Figure 12 Header - logged in user

The difference about the two headers are additional links for the logged in users like the Board or the link to Moodle. It was created this way to prevent bots to crawl the discussions in the board or the link to Moodle. Also it prevents spambots to flood the board.

<sup>4</sup> Moodle: Oauth2 Authentifizierung – MoodleDocs, 09.08.23, [https://docs.moodle.org/403/de/images\\_de/thumb/6/62/OAuth\\_-\\_Service\\_Provider\\_Authentication.png/600px-OAuth\\_-\\_Service\\_Provider\\_Authentication.png](https://docs.moodle.org/403/de/images_de/thumb/6/62/OAuth_-_Service_Provider_Authentication.png/600px-OAuth_-_Service_Provider_Authentication.png) (accessed 26.10.23)



The main page starts with the eMediator logo, menu bar, the short description “meeting individual educational needs” and the Erasmus+ Logo.



**Figure 13 Main page - first look**

After scrolling down, there is information about all five partner universities (Transport and Telecommunication Institute Riga, University of applied Science Aalen, University of Lodz, University of Murcia and University of Ioannina), information about the educational purpose, information about the project itself, and the project outlines and results.

The following topics about the page won't provide all pictures from the side, to provide a better clarity. The pictures not shown will be added in the appendix.

The board was realized with the plugin “WP Discussion Board”<sup>5</sup>, to create a simple and centralized place, for discussions about the project. Only logged in users can use the board to prevent bots from flooding it. It is used to discuss new functionality, reporting bugs and as a news board to introduce new functionality.

The course finder is a service, developed from the University of Ioannina. A user can use it for searching for a specific course of interest. With NLP-algorithm, the input from the users will be linked to the existing courses and needed skills and provides the user with two main information:

- Relevant courses with the following information
  - University
  - Degree
  - Level
  - Course
  - Description
  - Link (linking to the site of the course)

<sup>5</sup> <https://wpdiscussionboard.com/>



- Relevant skills with the following information
  - Description
  - Skills

For testing purposes of the algorithm, there are still test courses from other universities, which are freely available.

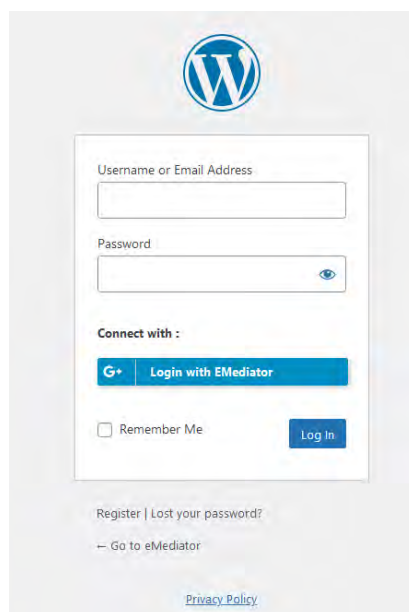
The footer is the bottom section of a website and provides further information like copyright, privacy policy, etc..



**Figure 14 Footer**

There are two ways of logging into the main page.

The first one is to create on own account under “Register”, the second one would be to use a google account.



**Figure 15 Login**

Moodle is the learning platform for eMediator. The login procedure is the same as on the landing page and is accessible via an own account or an google account. In addition, it is possible to enter as guest, meaning, you don't need an own account. This guest account on the other hand can only access courses, which are open to everyone.

Moodle is the learning platform for eMediator. The login procedure is the same as on the landing page and is accessible via an own account or an google account. In addition, it is possible to enter as guest, meaning, you don't need an own account. This guest account on the other hand can only access courses, which are open to everyone.

## Header

The header includes the eMediator logo, navigation bar, user settings, the Erasmus+ Programme logo and the project number.



**Figure 16 Moodle header**

Despite the normal links in the navigation bar, there was also eMediator added, which leads to the main page and to the course finder.

The dashboard contains all information needed by the user (student and teacher). The timeline shows the next courses for seven days, on which date and which time the course will be held. In addition, it has also a calendar integrated.

## 5.7 Courses

The course lists contain the following information:

- Name of the course
- Short description and goals
- Teacher
- eMediator logo in a specific colour

### Project Management Training Course ➡



This course offers a short introduction to project management, concentrating on key ideas such as project management concepts, value delivery systems, project success measurement, and methods for managing projects. Participants will learn the fundamentals of project management, providing value, and assessing project success.

**Teacher:** Alberto García

### Requirements Engineering Training Course ➡



This course covers the core ideas of requirements engineering and software engineering. It examines the main objectives of software requirements and the phases a project runs through in relation to them. It also discusses the basic characteristics of requirements and offers helpful advice on how to generate requirements.

**Teacher:** Alberto García

### e-Mediator Pedagogical Model ➡



The aim of the course is to bring you closer with the pedagogy elaborated within the e-Mediator Project. Specifically, you will know how to design courses on the platform and reach you audience.

**Figure 17 Moodle courses**

Each colour of the logo links to a specific type of course. Currently there are the following colours included:

- Grey → IT topic
- Orange → Management Topic
- Yellow → pedagogical topic
- Blue (standard eMediator logo) → no specific topic

The colours will be expanded when there are more topics available as courses.

## 5.8 Code Documentation and technical details

**version:** '3'

**services:**

**wp:**

**image:** wordpress:latest # [https://hub.docker.com/\\_/wordpress/](https://hub.docker.com/_/wordpress/)

**ports:**

- '80:80' # change ip if required

**volumes:**

- ./config/php.conf.ini:/usr/local/etc/php/conf.d/conf.ini

- ./wp-app:/var/www/html # Full wordpress project

**environment:**

WORDPRESS\_DB\_HOST: db

WORDPRESS\_DB\_NAME: "\${DB\_NAME}"



```

    WORDPRESS_DB_USER: root
    WORDPRESS_DB_PASSWORD: "${DB_ROOT_PASSWORD}"
  depends_on:
    - db
  links:
    - db

wpcli:
  image: wordpress:cli
  volumes:
    - ./config/php.conf.ini:/usr/local/etc/php/conf.d/conf.ini
    - ./wp-app:/var/www/html
  environment:
    WORDPRESS_DB_HOST: db
    WORDPRESS_DB_NAME: "${DB_NAME}"
    WORDPRESS_DB_USER: root
    WORDPRESS_DB_PASSWORD: "${DB_ROOT_PASSWORD}"
  depends_on:
    - db
    - wp

pma:
  image: phpmyadmin/phpmyadmin
  environment:
    # https://docs.phpmyadmin.net/en/latest/setup.html#docker-environment-variables
    PMA_HOST: db
    PMA_PORT: 3306
    MYSQL_ROOT_PASSWORD: "${DB_ROOT_PASSWORD}"
    UPLOAD_LIMIT: 50M
  ports:
    - '8080:80'
  links:
    - db:db

db:
  image: mysql:latest # https://hub.docker.com/_/mysql/ - or mariadb
  https://hub.docker.com/_/mariadb
  ports:
    - '3306:3306' # change ip if required
  command: [
    '--default_authentication_plugin=mysql_native_password',
    '--character-set-server=utf8mb4',
    '--collation-server=utf8mb4_unicode_ci'
  ]
  volumes:
    - ./wp-data:/docker-entrypoint-initdb.d
    - db_data:/var/lib/mysql
  environment:
    MYSQL_DATABASE: "${DB_NAME}"
    MYSQL_ROOT_PASSWORD: "${DB_ROOT_PASSWORD}"

volumes:
  db_data:

```



## Moodle Docker yaml file

```

version: '2'
services:
  mariadb:
    image: docker.io/bitnami/mariadb:10.6
    environment:
      - ALLOW_EMPTY_PASSWORD=yes
      - MARIADB_USER=bn_moodle
      - MARIADB_DATABASE=bitnami_moodle
      - MARIADB_CHARACTER_SET=utf8mb4
      - MARIADB_COLLATE=utf8mb4_unicode_ci
    volumes:
      - 'mariadb_data:/bitnami/mariadb'
  moodle:
    image: docker.io/bitnami/moodle:4.2
    ports:
      - '8100:8080'
      - '443:8443'
    environment:
      - MOODLE_DATABASE_HOST=mariadb
      - MOODLE_DATABASE_PORT_NUMBER=3306
      - MOODLE_DATABASE_USER=bn_moodle
      - MOODLE_DATABASE_NAME=bitnami_moodle
      - ALLOW_EMPTY_PASSWORD=yes
    volumes:
      - 'moodle_data:/bitnami/moodle'
      - 'moodledata_data:/bitnami/moodledata'
    depends_on:
      - mariadb
volumes:
  mariadb_data:
    driver: local
  moodle_data:
    driver: local
  moodledata_data:
    driver: local

```


Pictures from the landing page, Moodle and Liferay

Board:

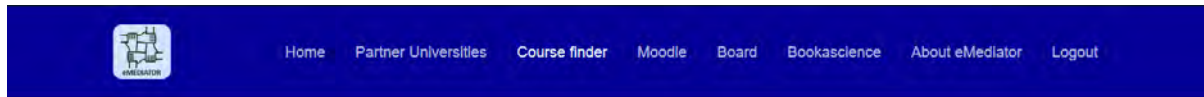



[Home](#)
[Partner Universities](#)
[Course finder](#)
[Moodle](#)
[Board](#)
[Bookscience](#)
[About eMediator](#)
[Logout](#)

## Topics

	Topic	Replies	Since
	<a href="#">Admin roles</a> Just write here, if you want to have an admin role. In addition, I need the info, if it will be on moodle or wordpress. <a href="#">Read More</a> Posted by: Christian Wilhelm	0	September 13, 2023

Course finder:



## Semantic search (Course finder)

Relevant Courses					
University	Degree	Level	Course	Description	Link
Oxford	computer science	BSc	Concurrent Algorithms and Data Structures	Java	<a href="#">Link</a>
Berkely	computer science	BSc	Data Structures	Introduction to the Java programming language	<a href="#">Link</a>

Relevant Skills	
Description	Skills
Experienced in creating server-side applications using languages like Node.js or Java	Backend Development
Competent in implementing collaborative coding using IBM Rational ClearCase version control platform	Code Collaboration with ClearCase (IBM Rational ClearCase) Implementation
Proficient in working with tools like Hadoop and Spark for processing large datasets	Big Data Technologies
Proficient in identifying and fixing vulnerabilities in web applications	Web Application Vulnerability Remediation
Proficient in using design patterns for serverless application development	Serverless Application Design Patterns

Mobile view



# eMediator


Meeting individual educational needs



With the support of the  
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## Moodle Dashboard


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[Dashboard](#)
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[Site administration](#)
[emediator](#)



AU
Edit mode

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Erasmus+ Project No. 2021-1-LV01-KA220-HED-000027571

### Dashboard

#### Timeline

Next 7 days
Sort by dates
Search by activity type or name



No in-progress courses

#### Calendar

All courses
New event

September
October 2023
November

Mon
Tue
Wed
Thu
Fri
Sat
Sun

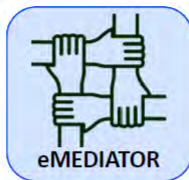


## Moodle Login

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[Lost password?](#)

**Log in using your account on:**



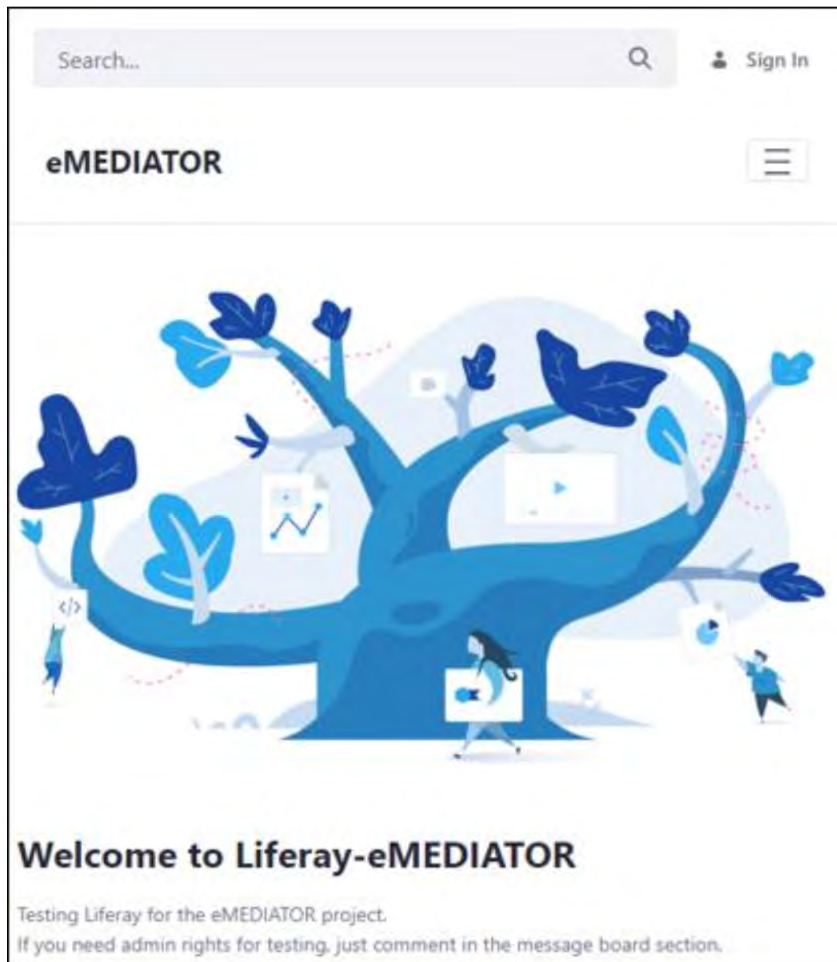
**Is this your first time here?**

For full access to this site, you first need to create an account.


**Some courses may allow guest access**

## eMediator Site – Liferay Portal – Pictures



### Mobile View



### Normal view

 Home






**eMEDIATOR**

Search...
 


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[Bookscience](#)
[moodle](#)

## Welcome to Liferay-eMEDIATOR

Testing Liferay for the eMEDIATOR project.  
If you need admin rights for testing, just comment in the message board section.

Please send high res images of your institute to christian.wilhelm@hs-aalen.de

## Course Finder Script

```

<!DOCTYPE html>
<html>

<head>
  <title>Semantic Search</title>
  <style>
    body {
      background-color: lightblue;
      font-family: Arial, sans-serif;
      margin: 0;
      padding: 0;
    }

    #tables-container {
      display: flex;
      justify-content: space-between;
    }

    #relevant-courses-table {
      flex: 1;
      /* Allow it to grow and fill available space */
      margin-right: 10px;
      /* Add some spacing between tables */
    }

    #skills-table {
      flex: 1;
      /* Allow it to grow and fill available space */
    }

    #header {
  
```



```

        background-color: white;
        padding: 10px;
        display: flex;
        align-items: center;
        justify-content: space-between;
    }

    #logo {
        width: 100px;
        height: 100px;
    }

    #search-container {
        text-align: center;
        margin-top: 50px;
    }

    #search-input {
        padding: 10px;
        font-size: 16px;
        border: 1px solid #ccc;
        border-radius: 5px;
    }

    #search-button {
        padding: 10px;
        font-size: 16px;
        border: none;
        border-radius: 5px;
        background-color: #4caf50;
        color: white;
        cursor: pointer;
    }

    #search-results {
        margin-top: 30px;
        text-align: center;
    }

    .result-item {
        padding: 5px;
        background-color: #f9f9f9;
        border: 1px solid #ddd;
        border-radius: 5px;
        margin-bottom: 10px;
        max-width: 600px;
        margin-left: auto;
        margin-right: auto;
    }

    #relevant-courses-table {
        display: none;
    }

    #skills-table{
        display: none;
    }

    #other-courses-table {

```



```

        display: none;
    }

    table {
        border-collapse: collapse;
        width: 100%;
        max-width: 700px;
        margin: 10px auto;
        border-radius: 4px;
        overflow: hidden;
        box-shadow: 0 2px 5px rgba(0, 0, 0, 0.1);
        background-color: #fff;
    }

    th,
    td {
        padding: 16px;
        border-bottom: 1px solid #ddd;
        text-align: left;
    }

    th {
        background-color: #f2f2f2;
        font-weight: bold;
    }

    /* Adjust the width of td elements to occupy full width */
    td {
        width: auto !important;
    }

    /* Align small content to the left side of the cell */
    td.small-content {
        text-align: left;
        width: auto;
        /* Set width to 'auto' to fit content */
    }

    caption {
        width: 598px;
        font-weight: bold;
        padding-top: 20px;
        font-size: 18px;
        margin-bottom: 8px;
        text-align: center;
    }

    /* Styling for the "We couldn't find any results" message */
    #empty-message {
        font-style: italic;
        color: #777;
        text-align: center;
        margin-top: 15px;
    }

    th {
        background-color: #f2f2f2;
        font-weight: bold;
    }

```





```

        text-align: center;
    }

    /* Separator between columns */
    tr {
        border-bottom: 1px solid #ddd;
    }

    /* Justify description text */
    td.description {
        text-align: justify;
    }
}
</style>
</head>

<body>

<div id="search-container">
    <input type="text" id="search-input" placeholder="Enter your query" />
    <button id="search-button" onclick="search()">Search</button>
</div>

<div id="search-results">
    <p id="empty-message"></p>
    <div id="tables-container">

        <table id="relevant-courses-table">
            <caption>
                Relevant Courses
            </caption>
            <thead>
                <tr>
                    <th>University</th>
                    <th>Degree</th>
                    <th>Level</th>
                    <th>Course</th>
                    <th>Description</th>
                    <th>Link</th>
                </tr>
            </thead>
            <tbody>
                <!-- JavaScript will dynamically add rows here -->
            </tbody>
        </table>

        <table id="other-courses-table">
            <caption>
                You can also view these courses
            </caption>
            <thead>
                <tr>
                    <th>University</th>
                    <th>Degree</th>
                    <th>Level</th>
                    <th>Course</th>
                    <th>Description</th>
                    <th>Link</th>
                </tr>
            </thead>
            <tbody>
                <!-- JavaScript will dynamically add rows here -->
            </tbody>
        </table>
    </div>
</div>

```

```

        </tr>
      </thead>
    </tbody>
    <!-- JavaScript will dynamically add rows here -->
  </tbody>
</table>
</div>
<div>
  <table id="skills-table">
    <caption>
      Relevant Skills
    </caption>
    <thead>
      <tr>
        <th>Description</th>
        <th>Skills</th>
      </tr>
    </thead>
  </table>
</div>
</div>
<script>
  let relevantCoursesTable;
  let otherCoursesTable;
  let relevantSkillsTable;
  let otherSkillsTable;
  let emptyMessage;

  function camelize(str) {
    return str.replace(/(?:^|w|_|b|w)/g, function (word, index) {
      return index === 0 ? word.toLowerCase() : word.toUpperCase();
    }).replace(/\s+/g, '');
  }

  window.onload = function () {
    relevantCoursesTable = document.getElementById("relevant-courses-table");
    otherCoursesTable = document.getElementById("other-courses-table");
    relevantSkillsTable = document.getElementById("skills-table");
    emptyMessage = document.getElementById("empty-message");
  };
  var input = document.getElementById("search-input");
  input.addEventListener("keypress", function (event) {
    if (event.key === "Enter") {
      event.preventDefault();
      document.getElementById("search-button").click();
    }
  });

  function search() {
    var query = document.getElementById("search-input").value;
    var xhr = new XMLHttpRequest();
    var relevantCourses = [];
    var otherCourses = [];
    var relevantSkills = [];
    var otherSkills = [];
    function createRelevantCourseRows(courses) {
      return courses
    }

```

```

        .map(
            (course) =>
                `<tr>
<td>${course.university}</td>
<td>${course.degree}</td>
<td>${course.level}</td>
<td>${course.course}</td>
<td class="description">${course.description}</td>
<td>${course.link
            ? `<a href="${course.link}" target="_blank">Link</a>`
            : ""
        }</td>
</tr>`
        )
        .join("");
    }

    function createOtherCourseRows(courses) {
        return courses
            .map(
                (course) =>
                    `<tr>
<td>${course.university}</td>
<td>${course.degree}</td>
<td>${course.level}</td>
<td>${course.course}</td>
<td class="description">${course.description}</td>
<td>${course.link
                    ? `<a href="${course.link}" target="_blank">Link</a>`
                    : ""
                }</td>
</tr>`
            )
            .join("");
    }

    function updateTables(relevantCourses, otherCourses) {
        if (relevantCourses.length > 0) {
            relevantCoursesTable.style.display = "block";
            emptyMessage.textContent = "";
            relevantCoursesTable.innerHTML =
                "<caption>Relevant
Courses</caption><thead><tr><th>University</th><th>Degree</th><th>Level</th><th>Course<
/th><th>Description</th><th>Link</th></tr></thead><tbody>" +
                createRelevantCourseRows(relevantCourses) +
                "</tbody>";
        } else {
            relevantCoursesTable.style.display = "none";
            emptyMessage.textContent = `We couldn't find any relevant courses`;
        }

        if (otherCourses.length > 0) {
            otherCoursesTable.style.display = "block";
            otherCoursesTable.innerHTML =
                "<caption>Relevant
Courses</caption><thead><tr><th>University</th><th>Degree</th><th>Level</th><th>Course<
/th><th>Description</th><th>Link</th></tr></thead><tbody>" +
                createOtherCourseRows(otherCourses) +

```

```

        "</tbody>";
    } else {
        otherCoursesTable.style.display = "none";
    }
}

function createRelevantSkillRows(courses) {
    return courses
        .map(
            (course) =>
                `<tr>
<td class="description">${course.description}</td>
<td>${course.skill}</td>
</tr>`
        )
        .join("");
}

function updateTableSkills(relevantSkills) {
    if (relevantSkills.length > 0) {
        relevantSkillsTable.style.display = "block";
        emptyMessage.textContent = "";
        relevantSkillsTable.innerHTML =
            "<caption>Relevant
Skills</caption><thead><th>Description</th><th>Skills</th></tr></thead><tbody>" +
            createRelevantSkillRows(relevantSkills) +
            "</tbody>";
    } else {
        relevantSkillsTable.style.display = "none";
        emptyMessage.textContent = `We couldn't find any relevant Skills`;
    }

    // if (otherCourses.length > 0) {
    //     otherCoursesTable.style.display = "block";
    //     otherCoursesTable.innerHTML =
    //         "<caption>Relevant
Courses</caption><thead><tr><th>University</th><th>Degree</th><th>Level</th><th>Course<
/th><th>Description</th><th>Link</th></tr></thead><tbody>" +
    //         createOtherCourseRows(otherCourses) +
    //         "</tbody>";
    // } else {
    //     otherCoursesTable.style.display = "none";
    // }
}

xhr.onreadystatechange = function () {
    if (xhr.readyState === 4 && xhr.status === 200) {
        relevantCourses = [];
        otherCourses = [];
        relevantSkills=[];
        var results = JSON.parse(xhr.responseText);
        console.log(results)
        results.Course.forEach(function (result) {
            if (result.similarity_score > 0.5) {
                relevantCourses.push(result);
            } else {
                otherCourses.push(result);
            }
        });
    }
}

```

```

    }
  });
  results.Skill.forEach(function (result) {
    relevantSkills.push(result);
  });

  updateTables(relevantCourses, otherCourses);
  updateTableSkills(relevantSkills)
}
};
xhr.open("GET", "https://emediator.kic.uoi.gr/search?query=" +
encodeURIComponent(query));
xhr.send();
}
</script>
</body>

</html>

```

## LIST OF AUTHORS

1. Nicolas Dolle
2. Christian Wilhelm