A micro-Learning Units Package for Improving Inclusive Digital Education in HEI

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Abstract

In Higher Education Institutions (HEIs), digital inclusion plays a crucial role in providing equitable and just access to educational materials for every student, irrespective of their varied origins, capacities, or impairments. To leverage HEIs and their ability to implement an inclusive educational system, this work considers identifying the factors that impact e-inclusion in HEIs to create a new content package of micro-learning units. These will cover categories such as leadership techniques, teamwork and networking, infrastructure needs, professional development, pedagogical support systems, classroom implementation, assessment procedures, and digital competency. The structured pedagogical content is supplied to the user through a recommendation model that constitutes an online self-evaluation tool.

Keywords

Inclusion, Learning Unit, Higher Education Institutions, Education, Educational Content

1 Introduction

Digital technologies have revolutionized the landscape of Higher Education Institutions (HEIs), enhancing accessibility and facilitating innovative teaching and learning methods. However, this digital transformation also underscores the imperative for digital inclusion, ensuring that all students have equitable access to educational resources regardless of their diverse backgrounds and abilities. Digital inclusion in HEIs is not merely about providing access to digital tools but involves a comprehensive strategy that encompasses leadership, infrastructure, professional development, and pedagogical innovations [6, 2].

Micro-learning units are small, self-contained learning modules designed to deliver targeted educational content in a flexible and accessible manner. These units can be particularly effective in promoting digital inclusion by allowing students, teachers, and HEI staff to engage with material at their own pace and according to their individual learning needs. Recent studies have shown that micro-learning can enhance engagement and retention by breaking down complex subjects into manageable segments [1, 3]. To create a comprehensive package of micro-learning units aimed at improving inclusive digital education, it is essential to identify the key factors that impact e-inclusion in HEIs. These

factors include leadership techniques, teamwork and networking, infrastructure needs, professional development, pedagogical support systems, classroom implementation, assessment procedures, and digital competency. By addressing these areas, the learning units can be tailored to provide practical and actionable insights that support educators and administrators in fostering an inclusive digital environment [4, 5].

This paper presents the development of a *micro-Learning Units Package* designed to enhance inclusive digital education in HEIs. By incorporating the identified factors that impact e-inclusion, this package aims to provide a structured and flexible pedagogical content delivery system. The micro-learning units will cover various essential categories and will be supplied to users through a recommendation model that includes an online self-evaluation tool. This approach ensures that the learning experience is personalized, responsive to individual needs, and conducive to fostering a more inclusive digital education environment.

The remaining paper is organized as follows. Section 2 addresses the key factors previously identified as enablers for digital inclusive education, and Section 3 describes the Learning package, its structure and content. Finally, Section 4 concludes the paper.

2 Factors for Inclusive Digital Education as Building Blocks

Identifying the factors that affect digital accessibility is here considered a previous starting point for constructing educational content. Policymakers, educators, and institutions can create plans and initiatives to support e-inclusion in HEI by recognizing these elements and how they interact. In this case, a set of micro-learning units was produced, making educational content available that relays and is organized based on the structure of the identified factors [4, 5].

The overall methodology consisted of four different stages. Firstly, a theoretical framework of inclusive digital education was developed, considering technology, pedagogy, content, management aspects, and different e-learning settings and modes. From this analysis, factors and indicators were obtained. Secondly, online workshops for refinement and validation of the variables and indicators were conducted in five countries (Italy, Portugal, Slovenia, Spain, and Turkey). In the workshops, the audience discussed and evaluated the framework, the factors, and the indicators). With the framework, the micro-learning package was created, consisting of a wide range of units as e-learning materials that cover all the factors and indicators previously identified. Thirdly, a second set of workshops was conducted to refine and validate the e-learning materials produced. Finally, a piloting stage was implemented in five European Universities, where management

Category	Factor	Indicator	uLearning Unit
1 Leadership/ School's perspective	Inclusive Digital Strategy and Policy for Empowering Inclusive Digital Education	LSP 1.1: An inclusive digital education strategy	Inclusive digital education strategy — 20 min
		LSP 1.2: Inclusive digital education strategy development with HEI staff	
		LSP 1.3: Established policies for enabling inclusive digital education	Policies for inclusive digital education — 20 min
		LSP 1.4: Communication of the policies for enabling inclusive digital education	
	Inclusive Digital Pedagogy & Supportive Culture	LSP 1.5: Support for contemporary pedagogical approaches to teaching with inclusive digital technologies	Support for inclusive pedagogical approaches to teaching with digital technologies — 15 min
		LSP 1.6: Minimized digital (education) discrimination	Minimized digital (education) discrimination — 15 min
		LSP 1.7: Collaboration and communication between the school and the teacher.	Collaboration and communication between the school and the teacher — 15 min
		LSP 1.8: Raising awareness on disability	Raising Awareness on Disability — 15 min
	Professional Development for Inclusive Digital Education	LSP 1.9: Time to explore inclusive (and accessible) digital technologies	Inclusive by Design: Advancing Digital Literacy for All — 30 min
		LSP 1.10: Acquiring knowledge and skills in digital literacy	
		LSP 1.11: New ways of inclusive digital teaching	
		LSP 1.12: Financial support for inclusive digital education	
2 Collaboration and Networking	Collaborative Evaluation and Planning for Inclusive Digital Teaching	CAN 2.1: Progress review	Collaborative planning, reviewing and managing — 30 min
		CAN 2.2: Discussion on the use of digital technology for inclusive teaching and learning	
		CAN 2.3: Collaborative planning and reviewing of inclusive courses	
		CAN 2.4: Collaborative planning and reviewing of inclusive teaching methods	
	Shared Vision and Collaborative Culture for Inclusive Digital Education	CAN 2.5: A common vision of digital educational inclusion	Vision and Collaborative Culture — 20 min
		CAN 2.6: Inclusive digital collaboration and communication between staff and students	
	Collaborative Engagement for Inclusive Digital Partnerships	CAN 2.7: Inclusive collaboration	Synergies for Inclusive Digital Education — 20 min
		CAN 2.8: Synergies for inclusive digital education	
3 Infrastructure and Equipment/ Tools and Technology	Accessible Infrastructure for Inclusive Learning	IET 3.1: Digital infrastructure	Is my digital infrastructure accessible and inclusive? — 20 min
		IET 3.2: Internet access	
		IET 3.3: Accessible physical spaces	Is my classroom accessible and inclusive?
		IET 3.4: Accessible online resources	Accessible online resources
	Accessible Devices for Inclusive Teaching and Learning	IET: 3.5: Digital devices and assistive products	What are Digital devices? Introduction — 15 min
		IET 3.6: School-owned portable devices and/or assistive products	Digital devices in my HEI — 20 min
		IET 3.7: Students' portable devices and/or assistive products	
		IET 3.8: Portable devices and/or assistive products	From Application to Implementation: Understanding HEI's Process for Accessible Learning Tools — 15 min
	Digital Accessibility Support for Inclusive Learning	IET 3.9: Technical support for inclusive digital teaching and learning	Digital Accessibility and Technical Support for Inclusive Learning — 20 min
		IET 3.10: Support for accessibility	
	Inclusion and Equity in Digital Learning	IET 3.11: Digital divide in inclusive education: Measures to identify challenges	Measuring and identifying challenges — 20 min
		IET 3.12: Digital divide in inclusive education: Support to address challenges	

Category	Factor	Indicator	uLearning Unit
4 Continuous Professional Development	Continuous Professional Development for Inclusive Digital Teaching	CPD: 4.1: Continuous Professional Development needs for inclusive teaching with digital technologies	Empowering Educators: Continuous Development for Inclusive Digital Pedagogy — 30 min
		CPD 4.2: Participation in Continuous Professional Development	
		CPD 4.3: Sharing experiences	
		CPD 4.4: Pedagogical skills	
		CPD 4.5: Informing about Continuous Professional Development activities	
5 Pedagogy: Supports and Resources	Inclusive Digital Resources	PSR 5.1: Inclusive educational resources	Inclusive digital educational resources — 30 min
		PSR 5.2: Creating inclusive digital resources	
		PSR 5.5: Inclusive open educational resources	
	Inclusive Digital Teaching Practices	PSR 5.3: Inclusive virtual learning environments	Digital Inclusivity in Education: Strategies and Best Practices — 30 min
		PSR 5.4: Inclusive communication with the community	
		PSR 5.6: Respond to digital diversity	Inclusive Digital Education Implementation Methodologies — 15 min
		PSR 5.7: Technical support for teachers	
6 Pedagogy: Implementation in the classroom	Personalized and Engaging Digital Learning	PIC 6.1: Tailoring to students' needs	Tailoring to students' needs, fostering creativity and engaging students — 20 min
		PIC 6.2: Fostering creativity	
		PIC 6.3: Engaging students	
	Inclusive Classroom Collaboration and Respectful Environment	PIC 6.5: Inclusive classroom environment	My classroom is inclusive! Part 1 — 15 min
		PIC 6.7: Equal value	Fostering Equal Value in HEI Classrooms — 15 min
		PIC 6.9: Collaboration with diverse students	Who is in my classroom? — 15 min
		PIC 6.8: Positive classroom environment	
		PIC 6.4: Inclusive collaboration among students	Fostering My classroom is inclusive! Part 2 — 20 min
		PIC 6.10: Trust and safety	Security first!Who is in my classroom? — 15 min
7 Assessment Practices/ Inclusion Assessment	Inclusive Digital Assessment Practices	AIA 7.1: Assessing skills	Inclusive assessment with digital technologies — 20 min
		AIA 7.2: Inclusive assessment with digital technologies	
		AIA 7.3: Timely feedback	Digital Feedback and Self-Reflection — 20 min
		AIA 7.4: Self-reflection on learning	
		AIA 7.5: Feedback on student's work	
	Data-Driven Improvement for Inclusive Digital Learning	AIA 7.6: Data-driven improvement of digital learning experience	Data-driven improvement of digital learning experience and Inclusiveness evaluation — 20 min
		AIA 7.7: Inclusiveness evaluation	
8 Pedagogy: Implementation in the classroom	Inclusive Digital Communication and Skills Development	DCP 8.1: Learning to communicate in an inclusive way	Development of Inclusive Digital Skills for Students — 30 min
		DCP 8.2: Development of digital skills and knowledge of inclusiveness	
		DCP 8.3: Sharing awareness among students	
		DCP 8.4: Development of required skills for inclusiveness	
		DCP 8.5: Solving technical problems	

Figure 1: Micro-Learning Units Mapping with Categories, Factors, Indicators, and Estimated Duration

and teachers were invited to test the entire pipeline and evaluate its performance.

The model of factors enabling inclusive digital education was categorized into 8 categories: (1) Leadership/ School's perspective; (2) Collaboration and Networking; (3) Infrastructure and Equipment/ Tools and Technology; (4) Continuous Professional Development; (5) Pedagogy: Supports and Resources; (6) Pedagogy: Implementation in the classroom; (7) Assessment Practices/ Inclusion Assessment; and (8) Student Digital Competence/ Student's Perspective, where each category embraces 1 to 4 factors. Besides each category, the theoretical model that identifies the factors is operationalized by considering a set of indicators. By tracking these indicators, stakeholders can gain insights into the effectiveness of digital inclusive education initiatives and identify areas needing improvement. In the context of digital inclusive education, an indicator is a specific measure or metric that provides information about the extent to which digital education resources and opportunities are accessible, equitable, and effective for all learners. These indicators help assess and monitor various factors such as access to technology, digital literacy, inclusivity, engagement, policy support, and educational outcomes, allowing educators, policymakers, and stakeholders to identify strengths, gaps, and areas needing improvement in implementing digital inclusive education.

For the first category, Leadership/School's perspective, three factors are considered: (1.1) Inclusive Digital Strategy and Policy for Empowering Inclusive Digital Education: This factor reflects the importance of an inclusive digital strategy, collaboration with leaders and teachers, and the establishment of enabling policies to reduce barriers to learning and participation; (1.2) Inclusive Digital Pedagogy & Supportive Culture: This factor encompasses supporting contemporary pedagogical approaches with inclusive digital technologies, minimizing digital discrimination, and fostering collaboration and communication between HEI staff and the organization; (1.3) Professional Development for Inclusive Digital Education where scheduled time for staff to explore inclusive digital technologies and supporting their acquisition of digital literacy knowledge and skills are considered.

When considering the second category, Collaboration and Networking, a set of three factor are considered: (2.1) Collaborative Evaluation and Planning for Inclusive Digital Teaching: highlighting the importance of reviewing progress in teaching and learning with inclusive digital technologies, discussing the advantages and disadvantages of inclusive teaching, and engaging in collaborative planning for inclusive courses and teaching methods; (2.2) Shared Vision and Collaborative Culture for Inclusive Digital Education: This factor emphasizes the importance of promoting a common vision of digital educational inclusion
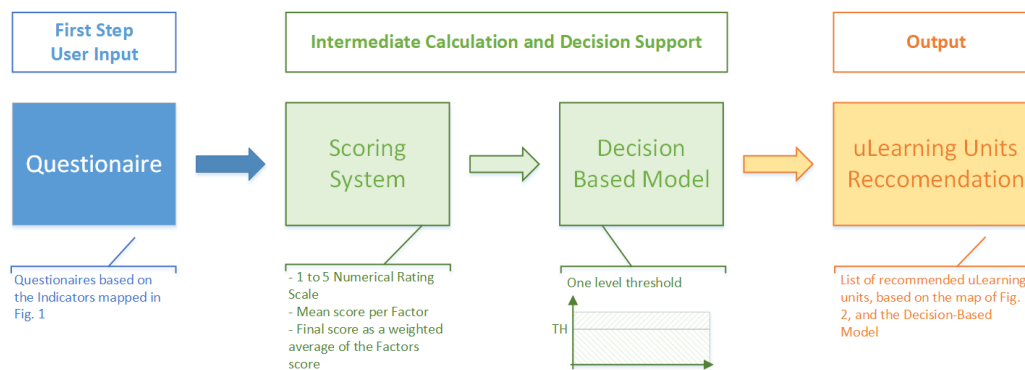
Figure 2: Recommendation Tool Model

among the main actors in the institution (management, pedagogical staff, students, and parents), as well as fostering inclusive digital collaboration and communication between staff and students; and (2.3) Collaborative Engagement for Inclusive Digital Partnerships: This factor highlights the importance of enabling inclusive collaboration with local communities, caregivers, and parents through digital technologies, as well as actively collaborating with other HEIs or organizations to support the use of inclusive digital technology.

Regarding Infrastructure and Equipment/ Tools and Technology, the third category, four factors are considered: (3.1) Accessible Infrastructure for Inclusive Learning: This factor highlights the importance of both digital and physical infrastructure in creating an inclusive learning environment; (3.2) Accessible Devices for Inclusive Teaching and Learning: This factor emphasizes the importance of providing accessible digital devices and assistive products for inclusive teaching in HEI; (3.3) Digital Accessibility Support for Inclusive Learning: This factor emphasizes the importance of HEI providing support for digital accessibility in order to facilitate inclusive learning; and (3.4) Inclusion and Equity in Digital Learning: This factor emphasizes the importance of HEI's efforts to identify and address the digital divide and challenges related to students' learning needs and socio-economic backgrounds in the context of digital learning.

Only one factor is identified for the fourth category, Continuous Professional Development: (4.1) Continuous Professional Development for Inclusive Digital Teaching. This factor emphasizes the importance of HEI leaders discussing and addressing continuing professional development needs for inclusive teaching with digital technologies. It also highlights the importance of providing staff with opportunities to participate in CPD and fostering the sharing of experiences within the school community.

Concerning the fifth category, Pedagogy: Supports and Resources, two factors are considered: (5.1) Inclusive Digital Teaching Practices: This factor emphasizes the importance of HEI teachers using virtual learning environments and digital technologies in an inclusive way, as well as being trained and instructed on how to address student diversity; and (5.2) Inclusive Digital Resources: This factor emphasizes the importance of HEI staff searching for inclusive digital educational resources, creating digital resources to support inclusive teaching, using inclusive open educational resources, and developing and updating resources that support inclusive learning and participation.

The sixth category, Pedagogy: Implementation in the classroom, involves three factors: (6.1) Personalized and Engaging Digital Learning: This factor emphasizes the importance of HEI staff using digital technologies to personalize and tailor their teaching to student's individual needs, incorporating digital learning activities that foster creativity, and setting inclusive digital learning activities that actively engage and motivate all students; (6.2) Inclusive Classroom Collaboration and Respectful Environment: This factor focuses on promoting inclusive collaboration and creating a respectful classroom environment using digital technologies; and (6.3) Enhanced Pedagogical Digital Inclusiveness: This factor emphasizes the focus on enhancing digital inclusiveness among pedagogical staff.

The seventh category, Assessment Practices/ Inclusion Assessment, embraces three factors: (7.1) Inclusive Digital Assessment Practices: This factor emphasizes the importance of HEI staff using inclusive and accessible digital technologies for assessing students' skills; (7.2) Digital Feedback and Self-Reflection: This factor emphasizes the importance of HEI staff using inclusive digital technologies to provide timely feedback to students, enable students to self-reflect on their own learning and facilitate peer feedback on other student's work, and (7.3) Data-Driven Improvement for Inclusive Digital Learning: This factor highlights the focus on leveraging digital data analysis and evaluation metrics to identify students' needs and improve their inclusive digital learning experience.

Finally, the last category, Student Digital Competence/ Student's Perspective, is considered with one factor: (8.1) Inclusive Digital Communication and Skills Development: This factor emphasizes the importance of HEI ensuring that students learn to communicate in an inclusive way using digital technologies and that they develop their digital skills and knowledge on inclusiveness across subjects. The factor reflects the focus on promoting inclusive communication practices and fostering the development of digital skills in relation to inclusivity.

3 The Micro-Learning Units Package

Based on the factors previously identified and described in Section 2, a newly package of micro-learning units was created. A micro-learning unit is a small, focused segment of educational content designed to teach a specific skill or concept in a brief period. These units are typically short, ranging from a few minutes to about 15 minutes, and are meant to be easily digestible and accessible. To organize the micro-learning units and to guarantee

Figure 3: Example of a Micro-Learning Unit Content

their integrity, the units are correlated to the indicators associated with each factor, also allowing directing the reader with the help of a self-evaluation tool as described in Fig. 2. The figure presents a comprehensive framework for the micro-Learning Units Package aimed at improving inclusive digital education in Higher Education Institutions (HEIs). It is organized into several categories, each addressing specific factors contributing to digital inclusion. Each category is further divided into factors, indicators, and corresponding micro-learning units with specified durations.

The user is first invited to answer a questionnaire that relies on the indicators. From this point, a scoring system evaluates the user's perception of each factor, and globally, in its aptitude in relation to digital and inclusive education. Then, a decision-based model advises the user on which micro-learning units it should be involved in. The estimated time frame for each unit varies from 15 to 30 minutes, depending on how many indicators it covers, since some indicators are cross-correlated and are thus blended into one micro unit. A total of 32 micro-learning units constitute the overall package, totaling seven hours, although the purpose of the tool is for the user to only study the units related to the topics they least mastered. Besides, the tool can be used cyclically, meaning it can be used several times until the overall score obtained from the self-evaluation reaches a satisfactory value, allowing the user to manage the learning path. Both the self-evaluation tool and the micro-Learning unit contents are allocated online at www.set4inclusion.eu. Figure 3 exemplifies how the unit *"Is my digital infrastructure accessible and inclusive?"*, related to indicators *"IET 3.1: Digital infrastructure"*, and *"IET 3.2: Internet access"*, associated to the factor *"Accessible Infrastructure for Inclusive Learning"*, under the category *"Infrastructure and Equipment/Tools and Technology"* is presented to the user.

When considering the presented micro-Learning package, wider content is broken down into small, manageable pieces, making it easier for learners to consume and understand, where each unit targets a single, specific learning objective, ensuring that learners can quickly grasp the intended concept or skill. Designed to be accessed on-demand through the self-evaluation tool, it allows learners to engage with the material at their own pace and on their own schedule. Also, the concise and focused nature of micro-learning units can improve retention by minimizing cognitive overload and reinforcing key points through repetition and varied presentation. Although the micro-Learning units are integrated into a larger educational framework, they are also effective as standalone lessons.

4 Conclusion

Using a self-evaluation tool, a set of micro-learning units previously mapped using factors and indicators of inclusive digital education is made available to a user through a recommendation model.

The global set of micro-training units covers a broad set of skills, considered based on the factors that involve inclusive digital education. With this procedure, the personnel involved in higher education institutions, teachers or staff, acquire the necessary skills to provide truly inclusive digital education in their institution.

Acknowledgments

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