JOURNAL OF E-LEARNING AND KNOWLEDGE SOCIETY
Vol. 20, No. 3 (2024), pp. 112-125

Integration of Educational Clusters with Open Badges and Blended Intensive Program (ECOBI): a comprehensive approach to future university education

Tommaso Minerva[1], Annamaria De Santis, Katia Sannicandro, Claudia Bellini

University of Modena and Reggio Emilia – Reggio Emilia (Italy)

(submitted: 2/10/2024; accepted: 1/11/2024; published: 4/11/2024)

Abstract

This paper introduces an integrated educational model for higher education, ECOBI, which combines Educational Clusters (teaching programs), the Blended Intensive approach, and the issuance of Open Badges within university curricula. Adopted by EDUNEXT, a network of 35 Italian universities aimed at digital educational innovation and university network development, ECOBI proposes a competency-based design that makes degree courses and Educational Clusters planned to develop specific skills relevant to the 21st-century landscape. The Intensive Blended approach integrates online teaching activities with intensive in-person training weeks, combining the strengths of both experiences. This model offers modularity and flexibility, promotes interdisciplinary learning and interchangeability of content, and meets the needs of current higher education. The article describes the ECOBI approach, its characteristics, strengths and advantages, and highlights its implementation within the EDUNEXT network.

KEYWORDS: University, Blended Learning, Open Badges, Competencies, Interuniversities Collaboration.

DOI
https://doi.org/10.20368/1971-8829/1136068

CITE AS
Minerva, T., De Santis, A., Sannicandro, K., & Bellini, C. (2024). Integration of Educational Clusters with Open Badges and Blended Intensive Program (ECOBI): a comprehensive approach to future university education. *Journal of e-Learning and Knowledge Society*, *20*(3), 112-125.
https://doi.org/10.20368/1971-8829/1136068

1. Introduction

Higher education is undergoing a significant transformation due to rapid technological advancements, globalization, and evolving labor market demands. Traditional educational models, characterized by rigid curricula and face-to-face instruction, are increasingly challenged to meet the needs of modern learners who require flexibility, personalization, and acquisition of competencies relevant to the 21st-century landscape (Selwyn, 2014). Students starting university today need to acquire digital, social, and hard skills and learn the approaches to continue training and combine new skills with existing ones because, in part due to rapid technological development, they are likely to perform new jobs just emerged for which training systems cannot always provide the necessary competencies (Beke et al., 2020; Stephany & Teutloff, 2024; Suhasini & Santhosh Kumar, 2019). Higher education institutions may struggle to cultivate complex, interdisciplinary, and soft competencies in graduates effectively, necessitating the adoption of different teaching and learning models just like blended learning and competency-based approach can be.

Blended learning (Hrastinski, 2019) has emerged as a promising approach to combine the strengths of online and face-to-face experiences (Garrison & Vaughan, 2008; Graham, 2013; Bonk & Graham, 2013), to offer flexibility and cater to diverse learning preferences, which is crucial in accommodating today's heterogeneous student populations and promoting accessibility. Research has presented the effectiveness of blended learning in higher education settings (Means et al., 2013; Garrison & Kanuka, 2004; Han et al., 2023) and the critical role in tutoring and supporting students (MacDonald, 2008; Baran et al., 2011; Langesee, 2023; Helleken et al., 2024).

Some universities have started using competency-based education that focuses on developing and assessing

[1] corresponding author – email: tommaso.minerva@unimore.it

specific competencies rather than time spent in class. Well-known frameworks have underlined the role of skills and goals in the course design. *Backward design* (Wiggins & McTighe, 2005) advocates for starting with the end in mind by identifying desired learning outcomes and designing curriculum accordingly. The *constructive alignment in teaching* (Biggs & Tang, 2011) highlights that the link among learning activities, assessments and the intended learning outcomes ensures students acquire the competencies necessary for their professional and personal development.

Global Education Movement (GEM), an online initiative of Southern New Hampshire University, offers competency-based education university programs to refugees around the world allowing students to earn degrees by demonstrating mastery of specific competencies (gem.snhu.edu). The University of Wisconsin provides the UW Flexible Option, a self-paced, competency-based online program designed for adults where students progress by demonstrating knowledge and skills acquired at their own pace (flex.wisconsin.edu).

A means of recognizing and verifying competencies acquired by learners is the use of digital badges, particularly Open Badges, that are portable, shareable, and contain metadata that provides detailed information about the skills and achievements they represent (Clements et al., 2020). Studies highlight the potential of digital badging to motivate learners and provide formal acknowledgment of skills in higher education settings (Carey & Stefaniak, 2018). Universities and organizations worldwide are adopting digital badges to certify micro-credentials and competencies (HolonIQ, 2023; Iniesto et al., 2022; Gish-Lieberman et al., 2021; Cedefop, 2023). This trend reflects a shift towards more granular recognition of learning, allowing students to showcase specific skills to employers and academic institutions.

The Open University in the United Kingdom provides free online resources and courses through the free learning platform OpenLearn. Completing all sections of the badged course and passing the assessments, students can obtain a badge and demonstrate an interest in a subject and evidence of professional development (open.edu/openlearn/badged-courses). In the perspective of credentialing and badging, Deakin University in Australia offers the service "professional practice credentials" to certify credentials on soft skills with digital badge aligned with industry needs. They assess and recognize skills acquired through work and life experiences without participating in a course but only showing evidence of skill acquisition (credentials.deakin.edu.au). Similarly, the University of California Davis implemented a digital badging initiative to recognize co-curricular learning and competencies gained outside the traditional classroom in continuing and professional education (cpe.ucdavis.edu/digital-badges).

Networks of higher education institutions are exploring collaborative models to leverage shared resources and expertise, fostering innovation, enhancing quality, and addressing common challenges (Huxham & Vangen, 2005). European networks like the Coimbra Group, long-established European multidisciplinary universities of high international standard (coimbra-group.eu), and the League of European Research Universities, LERU (leru.org) promote collaboration among universities to enhance quality and innovation in research and teaching. The nonprofit organization Open Universities Australia (open.edu.au) provides a catalogue of higher education programs (undergraduate and postgraduate degrees, university certificates, microcredentials, and short courses) from 25 leading Australian universities online offering personalized guidance to students in online campuses.

In the Italian context, an initiative of the Ministry of University and Research for teaching innovation led to the establishment of three Digital Education Hubs (DEHs) in the country (Decree n. 983 of 24.07.2023) within the actions of the National Recovery and Resilience Plan (NRRP), part of the European program Next GenerationEU.
Thirty-five universities, along with five conservatories and academies, have united to form EDUNEXT, one of the DEHs dedicated to innovating traditional university education. EDUNEXT aims to design and produce bachelor's and master's degree courses using a modular and blended approach, as well as develop online courses, micro-credentials, and MOOCs. Coordinated by the University of Modena and Reggio Emilia, which has a 20-year history in online learning activities, the network is supported by 55 external partners, including regional institutions, cultural organizations, associations, and businesses (see edunext.eu for the list of universities and partners).

EDUNEXT's inter-university collaboration builds upon the experience of EduOpen (learn.eduopen.org), a nationwide initiative launched in 2016 that remains active in MOOC production by aggregating 24 universities and 7 cultural or educational institutions. The EduOpen experience provided guidelines for course development processes, recommended technologies, staff composition, and insights into student behaviors (De Santis et al., 2023; Sannicandro et al., 2019).

Embodying a collaborative spirit, EDUNEXT adopts a unified model called ECOBI, which stands for "Educational Clusters with Open Badges and Blended Intensive Program". ECOBI integrates educational clusters, blended intensive programs, competency-based design, micro-design elements, comprehensive tutoring, and open badging to create a flexible and student-centered educational experience.

The ECOBI model can be applied to degree programs, comprehensive educational offerings of a university or

training institution, or networks of institutions and universities (such as EDUNEXT), where standardized processes ensure the interchangeability of content and quality assurance procedures.

This paper presents the ECOBI model, detailing its components and its advantages. By reviewing relevant literature and aligning with international trends, the ECOBI model positions EDUNEXT at the forefront of educational innovation, addressing the challenges and opportunities of modern higher education. The already described international initiatives share similarities with the ECOBI model, demonstrating a commitment to the same topics, providing valuable insights, and reinforcing the relevance of ECOBI in a global context.

After this brief introduction on the global trends and initiatives, the second section of the paper describes the ECOBI components; the third section discusses the integration of technologies in the model. Section 4 presents the advantages of ECOBI for students, teachers, institutions, the whole society, and the labor market. Conclusions follow in Section 5.

2. The ECOBI model

ECOBI integrates its key components, that are educational clusters, open badges, blended approach, micro-design elements, and tutoring, to provide a complete and innovative learning experience in higher education.

In brief, faculty members (also from different universities) work together to develop degree courses, incorporating competency-based design and micro-design elements. The combination of online and in-person activities, supported by a team of expertise, allows for personalized learning experiences and an effective use of technologies for educational purposes.

The degree courses are structured into educational clusters that are teaching programs on a specific domain and are composed of small modules focused on the acquisition of micro-skills. Upon passing cluster and module assessments, students receive open badges that attest to their competencies, enhancing transparency and portability of skills.

ECOBI model ensures consistency, fairness and constant improvement of the educational offering by uniforming assessment criteria, shared standards for open badges, continuous monitoring and regular evaluation of the program, with contributions from all stakeholders.

We describe the key elements of ECOBI in more detail in the following paragraphs.

2.1 Educational Clusters

A key element of the ECOBI model is the Educational Cluster, defined as a coherent set of modules within a university program, each worth 3 ECTS credits (24 hours of instruction, based on 8 hours per credit).

The modules, by content and objectives, contribute to the acquisition of specific learning outcomes that more broadly characterize the integrated teaching program (cluster). So, clusters can be either *multidisciplinary*, integrating modules from different scientific disciplines to promote interdisciplinary learning, or *monodisciplinary*, focusing on a single discipline for specialized, in-depth study.

We have chosen the term “cluster” instead of course or similar since these are modules of training that need not necessarily succeed one another but can enable students to achieve a specific educational goal together. In fact, modules can be delivered *sequentially* so that each is preparatory to the next or *concurrently* if they are independent, although they are part of the same cluster.

The organization into clusters fosters modularity and flexibility.

Additionally, standardizing parameters such as the number of hours per credit (8) and of credits per module (3) facilitates the exchange of credits, modules, and programs among degree courses and, more generally, as aimed in EDUNEXT, among universities. Students can attend and combine modules from different degree courses and institutions, creating personalized educational pathways aligned with their interests and professional objectives.

At the European level, each ECTS matches a student’s commitment of between 25 and 30 hours, including class hours, individual study, and other learning activities. Italian regulations bring the amount of hours to 25. The allocation of 1/3 of the hours for class activities and 2/3 for individual study in the credits system reflects a well-established educational tradition in the Italian university system, supported by the internal regulations of many Italian universities and considered an effective teaching practice to balance guided learning and student autonomy.

2.2 Competency-Based Design

ECOBI emphasizes the design phase (Reiser et al., 2017) of clusters and modules, given their complexity in a blended approach to ensure they are meaningful to the student’s learning path.

Each module and cluster is built in a process of competency-based design. By focusing on competencies, the ECOBI model promotes the development of relevant and transferable skills to real-world contexts (Yorke, 2006; Tomlison, 2017).

The design process (Wiggins & McTighe, 2005; Biggs & Tang, 2011), carried out with the support of instructional designers, involves:

- identifying competencies: the teacher's board has to articulate what students should know and be able to do upon completion of the degree path and at the end of each cluster and modules.
- creating assessments: assessments have to accurately measure the defined competencies using practical and authentic tasks.
- designing learning activities and teaching methods: teachers have to choose lectures, activities, and teaching strategies that facilitate the acquisition of the defined skills.

2.3 Assessment and Open Badges

Assessment strategies are designed to measure and validate the competencies acquired by students at both the module and cluster levels, ensuring academic integrity, rigor, and alignment with learning outcomes. ECOBI provides the recognition of achievements through Open Badges.

Each module consists of a specific assessment to measure the competencies acquired (or knowledge in the basic modules or clusters). It may include essays, practical tasks, or projects, and multiple-choice questions, depending on the module's nature and can be conducted online or at designated testing centers or university facilities using secure proctoring software. Upon successful completion, students don't receive university credits, but detailed feedback and an Open Badge that formally certifies the competencies gained in that module. The badges, shareable on professional platforms, contain metadata about the issuer, criteria, and evidence of learning. They can also have an expiration date, just like acquired skills that may be valid for a certain period or effective in a given context, especially with the increasingly pressing technological transformation that requires people to adapt and update their skills continually.

Upon completing all modules within a cluster and passing the cluster's final assessment (in-presence), students receive ECTS and a Milestone Open Badge. The final assessment highlights and validates the comprehensive competencies acquired across all modules and can be a project integrating knowledge and skills from each module (Guo et al., 2020), a portfolio of work completed throughout the modules (Barrett, 2007), or oral examinations or presentations to a panel of faculty members. The Milestone Open Badge represents a significant achievement, conditioned upon the acquisition of the individual module badges, and symbolizes the integration and mastery of the cluster's competencies.

Table 1 presents an example of the structure of a cluster, namely "Techniques for data analysis in educational research", corresponding to 18 credits and 144 teaching hours distributed between online and in-presence activities. The table also contains the competencies acquired by students at the end of the training and listed in the design phase and the assessments for each module and for the whole cluster.

Modules in pairs (1 and 2, 3 and 4, 5 and 6) can be delivered simultaneously.

Table 1 - Example of modules in the Educational Cluster "Techniques for data analysis in educational research".

Cluster	Techniques for data analysis in educational research		
Competencies (at the end of the program students will be able to...)	- define the characteristics of multivariate statistical analysis techniques and their application in education - perform analyses using the R/R-studio package - write a scientific report		
Final exam	Test + Group project work (analysis of a dataset) with report, presentation and discussion		
Module	**Credits**	**Study field**	**Assessment**
1. Educational Research and Learning Analytics	3	Education	Proctored test
2. Introduction to R	3	Statistics	Brief data analysis report + script with R
3. R and regression techniques	3	Statistics	Brief data analysis report + script with R
4. Regression analysis in educational research	3	Education	Brief report on a case study
5. R, classification and data reduction techniques	3	Statistics	Brief data analysis report + script with R
6. Classification and data reduction techniques in educational research	3	Education	Brief report on a case study

2.4 *Intensive* Blended approach and micro-design

Programs in the ECOBI model are delivered according to a blended approach. We propose a system in which both online and face-to-face educational practices are valued meaningfully, making their integration a daily and fundamental practice.

As said before, the standard instructional load is 8 hours per ECTS credit, excluding interactive and tutoring activities.

In the ECOBI model, the division between in-person and online teaching hours can vary between a minimum of 50% online teaching to a maximum of 75%, with a

standard model of one-third in-person and two-thirds online. This flexible structure accommodates different disciplines and teaching strategies.

In Table 2 we propose, as an example, the amount of activities to plan in a module delivered in the standard model (67% of online activities).

Table 2 - Distribution of classroom and online activities for a module (3 ECTS = 24 hours excluding interactive activities) in the standard model of one-third in-person and two-thirds online.

Activities in a Module (67% online)	Hours
Classroom lectures	8
VideoLectures	16
Estimated time for e-tivity	6
Online meetings with disciplinary tutors	6

Online activities primarily consist of pre-recorded videolectures with a maximum duration of 15 minutes. These micro-lectures enhance engagement and cater to students' shorter attention spans in online environments facilitating a better understanding of complex topics (Guo et al., 2014). Guidelines emphasizing the importance of clear objectives and interactive elements for creating effective educational videos have been proposed (Brame, 2016).

The videolectures are counted for teaching load calculations with a correction factor of 2, acknowledging the additional effort required for their preparation. The same doubled amount of hours is calculated for students because videos are denser and more concise in language and content than a classroom lecture and may require students to listen several times for effective content acquisition. So, in the proposal of Table 2, the actual number of hours to record is 8 instead of the 16 declared.

In addition to videolectures, faculty with the help of disciplinary tutors are required to design and provide e-tivities (Salmon, 2013), structured online interactive activities also included in Italian ministerial documents, quantifiable as at least 2 hours of student engagement per ECTS. E-tivities promote active learning and collaboration and facilitate deeper understanding of the material. Some examples include forum discussions, group projects, simulations, and formative assessments.

Integrating micro-design elements such as micro-lectures, e-tivities, and comprehensive tutoring can enhance the effectiveness of blended learning environments (Graham & Draper, n.d.; Borup et al., 2022; Kossen & Ooi, 2021; Liu et al., 2024; Bower et al., 2015).

In-person sessions are organized in intensive weeks and includes practical laboratories, workshops, simulations and collaborative projects (Johnson et al., 2014; Vlachopoulos & Makri, 2017; Guo et al., 2020). These sessions are crucial for hands-on experiences and face-to-face interactions that enrich the learning process (Prince, 2004; Qureshi et al., 2023). The Blended Intensive Program (BIP) approach, captured from the well-known mobility projects of European Erasmus+ Programme, is the methodological component of ECOBI that effectively integrates online learning with intensive in-person sessions for each module, optimizing the learning process by leveraging the strengths of both teaching methods.

Even if requiring careful planning, concentrating practical activities in one week optimizes the use of teaching and logistical resources, better managing time and infrastructure. Subjects who are not full-time students see thus facilitated class attendance. Generally, for all students, the intensive blended approach creates the opportunity for direct interaction with faculty and colleagues. Additionally, it enriches the educational experience, preparing students for professional dynamics often based on autonomous training (Zimmerman, 2002) and practical and collaborative activities.

The mix of e-tivities and in-presence activities aims to create community of learning and research among students and teachers reflecting the main university mission.

Table 3 describes an example of scheduling in weeks of a semester when educational clusters cover 30 ECTS. The online and in-presence activities are organized in 12 weeks.

Table 3 - Example of weekly distribution of activities for a semester according to the ECOBI Blended Intensive approach.

Blended Intensive approach for a semester - 30 ECTS 240 hours of teaching activities plus e-tivities and online meetings: - 80 hours of in presence activities - 160 hours of online activities			
Week	**Mode**	**Hours**	**Activities**
1	In-presence	16 (2 days)	Starting lectures on requirements and modules' scheduling
2-3	Online	20 per week	Videolectures (10 hours), e-tivities, virtual meetings with tutors
4	In-presence	24 (3 days)	Laboratories, workshops, and collaborative projects
5-7	Online	20 per week	Videolectures, e-tivities, virtual meetings with tutors
8	In-presence	24 (3 days)	Laboratories, workshops, and collaborative projects
9-11	Online	20 per week	Videolectures, e-tivities, virtual meetings with tutors
12	In-presence	16 (2 days)	Closing activities

The described blended approach derives from and complies with Italian regulations on higher education institutions and quality evaluation system for universities and research bodies. To name a few:

- Ministerial Decree No. 509 of November 24, 1999, introduced university credits corresponding to 25 hours of student effort, of which not less than half should be devoted to individual study (with some exceptions for experimental or practical training activities). In agreement with this and with long-established practices in Italian universities, in the ECOBI model, 8 hours are devoted to co-presence activities between students and teachers.
- since the 2014 accreditation guidelines for degree courses and subsequent updates produced by ANVUR (Italian National Agency for the Evaluation of Universities and Research Institutes), each university credit in online programs has to contain lectures (videos) and interactive activities. Credit is matched to a minimum number of 6 hours (a threshold to exceed hopefully), individual or collaborative e-tivities are to be included, and videolectures duration has to be considered double because students are likely to listen to them more times to acquire concepts. Our model fits these principles.
- M.D. No. 1154/2021 and M.D. 773/2024 provide for establishing *blended* degree programs with a percentage between 20 and 67 percent of online educational activities and *mainly online* degree programs with more than two-thirds of the activities online. The ECOBI model, with online activities between 50% and 75%, falls entirely within the two cases of the decrees.

2.5 A system of expertise: teaching, design, production and tutoring

In the ECOBI model, the degree courses resulted from the joint work of professional figures, namely teachers, technicians, instructional designers, and tutors. With different expertise and skills, they are involved in recurrent training and contribute to making learning paths structured, quality, and sustainable.

Teachers and students are the central figures of the process. Competency-based design requires a different learning approach by learners and a rethinking of faculty' tasks in a student-based approach that emphasizes the evolving roles and competencies needed of online teachers (Baran et al., 2011; Laferrière et al., 2006; Bates, 2022), highlighting the importance of professional development and support structures (Stensaker, 2018).

Technicians as Application Managers provide assistance to students in the use of digital systems and platforms and support to lecturers by configuring virtual and LMS environments, managing audio-video equipment installed in classrooms, specific software for screen recording and videoconferencing activities, and applications (including in the cloud) for the multimedia production. Performing a particular function among the technicians are the Media Producers responsible for producing educational videos and working primarily with faculty.

Considering the critical role in supporting students and faculty in blended models, ECOBI incorporates two levels of tutoring (Massuga et al., 2021; MacDonald, 2008; Li et al., 2017), system tutoring and disciplinary tutoring.

System tutors, as Instructional Designers (Halupa, 2019; Magruder et al., 2019; Koszalka et al., 2013), supply support to faculty assisting in the design and development of modules, ensuring alignment with competency-based approaches, effective pedagogical strategies and use of technology.

Disciplinary tutors in each module within a cluster are experts in the specific subject area and engage directly with students, providing subject-specific support, facilitating discussions, and monitoring progress (Vegliante & Sannicandro, 2020; López-Gómez et al., 2020). Their roles include:

- student interaction: engaging with students, proposing e-tivies, fostering a supportive learning environment, and addressing content-related inquiries.
- online tutoring sessions: conducting at least 1 hour per week, providing additional explanations, and facilitating discussions.
- monitoring and feedback: tracking student performance, providing timely feedback, and initiating interventions to support student success.

2.5 Quality Assurance and Standardization

A quality assurance system (Staring et al., 2022) based on the standardization of clusters structure, content production and procedure, continuous monitoring and regular evaluation of the program, assessment criteria and shared standards for open badges within ECOBI ensures consistency, fairness, and skills recognition.

Faculty, technicians, instructional designers, and tutors receive regular training in blended learning, competency-based instruction, and educational technologies. The panel of professionals works in the production of degree courses, assuring that each phase's results comply with the guidelines we summarize in Table 4.

Alignment with national and European frameworks, such as the European Credit Transfer and Accumulation System (ECTS), the European Qualifications Framework and the Bologna Process, allows recognition of credits and facilitates national and international collaboration.

3. Open and emerging technologies in ECOBI model

The technologies in the ECOBI model replay as much as possible to two adjectives: *open* and *emerging*.

The infrastructure underpinning the e-Learning system for educational content distribution, interaction and monitoring uses an "Open Source First" approach favoring established Open Source solutions (e.g., Moodle, PeerTube, BigBlueButton) in the first instance. It includes basic systems such as Learning Management System, Video Catalog, Collaborative Environments, Data Storage, Web Conferencing, Multimedia Production Environments (Minerva et al., 2022).

Meanwhile, the ECOBI model embraces emerging technologies to enhance the educational experience, support instructional design, and monitor the learning process. By integrating Artificial Intelligence (AI), Virtual Reality (VR), Augmented Reality (AR), and Machine Learning Analytics, ECOBI leverages cutting-edge tools to provide immersive, personalized, and data-driven education.

The incorporation of these emerging technologies aligns seamlessly with the ECOBI model:

- enhancing e-tivities and micro-lectures: AI and VR/AR technologies enrich online components, making learning more interactive and engaging (Popenici, & Kerr, 2017).
- supporting tutoring roles: AI tools assist system and disciplinary tutors in monitoring student progress and customizing support (Ait Baha et al., 2024; Labadze et al., 2023).
- improving assessment methods: advanced analytics inform the design of assessments and provide deeper insights into student learning (Knight et al., 2014; Lang et al., 2022).

While leveraging emerging technologies, ECOBI remains mindful of ethical considerations (Ferguson et al., 2016; Willis et al., 2016; Slade & Prinsloo, 2013; Drachsler & Greller, 2016; Bellini et al., 2019):

- data privacy: ensuring the confidentiality and security of student data collected through AI and analytics tools.
- equity and inclusion: providing access to necessary technologies and accommodating diverse student needs to prevent a digital divide (Liasidou, 2014).
- transparency: being clear about how AI systems and analytics are used in the educational process, maintaining trust and accountability.

Some specifics on the emerging technology to be implemented are in the following paragraphs.

Artificial Intelligence in instructional design and learning

Artificial Intelligence systems and tools are utilized in education (Chen et al., 2020) to assist faculty and instructional designers in creating effective and personalized learning experiences and serve as educational tools within the ECOBI model.

In fact, AI tools can be helpful in developing curricula, analyzing vast amounts of educational content to recommend resources aligned with learning objectives and competencies, and creating adaptive learning paths based on individual student profiles and prior knowledge. They are also used for content generation in developing assessments, e-tivities, and instructional materials that are tailored to competency-based design, to provide students with immediate feedback and support through AI-driven virtual tutors (Intelligent Tutoring Systems) and enable interactive learning experiences based on Natural Language Processing, such as AI-powered chatbots that answer student queries and facilitate discussions (Ilieva et al., 2023).

Virtual Reality (VR) and Augmented Reality (AR) for Immersive Learning

VR and AR technologies (Billinghurst et al., 2015) creates immersive learning environments that enhance understanding and engagement (Radianti et al., 2020; Jensen et al., 2020) and are functional for both online and in-presence teaching. They offer the possibility to students of experimenting and learning from practices, procedures, and contexts they might not otherwise experience. Some examples are:

- virtual laboratories that allow students to conduct experiments and practice skills in a risk-free, simulated environment.
- field simulations that enable experiences that would be difficult or impossible in real life, such as exploring historical sites or complex systems.
- interactive scenarios that provide opportunities for problem-solving and decision-making in realistic contexts, supporting the development of competencies.

During the intensive in-person weeks organized in the ECOBI model, in equipped educational laboratories, VR and AR technologies enrich hands-on activities through the realization of collaborative projects where students work together in virtual environments, fostering teamwork and communication skills and in the use of augmented learning materials.

Analytics for Monitoring and Improvement

Reporting, analysis, and monitoring systems are fundamental to the ECOBI model since many learning activities and formative and summative assessments are conducted online.

These systems are integrated into LMS or are custom-developed on AI processes, multivariate analysis, and Machine Learning on data generated in the interaction of students and teachers among them and with the platform.

Data analysis is made accessible to those involved in various capacities in the process (faculty, tutors, IDs, technicians) to monitor and enhance the educational process at different levels for supporting decision-making and quality assurance. They allow the forecasting of student outcomes and identify students at risk or who may benefit from additional support, enabling disciplinary tutors/teachers to provide timely and targeted assistance (Akçapınar et al., 2019; Ifenthaler & Yau, 2020).

The ECOBI system includes monitoring solutions such as Learning Analytics Dashboards (Verbert et al., 2013; Schwendimann et al. 2017; Ramaswami et al., 2023; Masiello et al., 2024; De Santis et al., 2024) that provide real-time data on student engagement, progress, programs and server use.

Table 4 - Brief Guidelines of the ECOBI Model.

ECOBI main features	Topic	Description
Competency-based design	Competency-based education	To reply to society requests, ECOBI proposal is based on the skills students need to acquire to become good and competent citizens. The design of degree courses and teaching activities starts from the knowledge, ability, and behaviors students will show at the end of the training.
	Constructive alignment	Strict matching is designed among educational goals, assessments, and learning activities/strategies.
	Micro-design	Short videolectures, e-tivities, and tutoring process are key elements in ECOBI online teaching programs.
Educational Clusters and Modules	Educational clusters	Educational Clusters represent university programs on a specific domain within a degree that are composed of modules and last 12-15-18 ECTS. They can be multidisciplinary or monodisciplinary, sequential or parallel.
	Modules	Each module is worth 3 ECTS credits and aims to make students achieve a micro-skill.
	Teaching hours	The standard instructional load is 8 hours per ECTS, excluding interactive and tutoring activities.
Intensive blended approach	Blended approach	Modules consist of a combination of in-person and online hours, with online teaching comprising 50% to 75% of total hours with a standard model of one-third in-person and two-thirds online. The mix of online and in-presence collaborative activities aims to value both practices meaningfully, make their integration a daily and fundamental practice in the educational contexts, and create a community of learning and research among students and faculty.
	Online components	• Videolectures: pre-recorded, maximum 15 minutes, counted with a correction factor of 2 for teaching and learning load. • E-tivities: interactive online activities amounting to at least 2 hours of student engagement per ECTS. • Tutoring: online classrooms or individual meetings with tutors/teachers.
	In-person intensive week	In each cluster, teachers define some in-presence weeks with a structured timetable dedicated to practical application, labs, workshops, group work, and direct instructor interaction that encourages active student participation and collaboration.
Assessments	Competency-based approach	Assessments are designed to directly evaluate the specific competencies outlined in the module/cluster objectives.
	Assessment formats	Assessment may include multiple-choice questions, essays, practical tasks, presentations, or projects, depending on the module and cluster's nature, emphasizing real-world problems and interdisciplinary issues.
	Proctored examinations	Modules may conclude with proctored assessments online or at designated testing centers.

(continue...)

Table 4 - Brief Guidelines of the ECOBI Model.

ECOBI main features	Topic	Description
Badges	Open badges for modules	It is awarded upon successful completion of each module's assessment.
	Milestone open badge	It is awarded upon completion of all module badges and the cluster's final examination, symbolizing the integration of competencies.
	Feedback mechanisms	Detailed feedback is provided on e-tivities to guide future learning, facilitated by disciplinary tutors, also using AI-based tools.
Technology	Open Source First	When possible, ECOBI model propose the use of Open Source solutions.
	Use of technology	ECOBI model focuses on emerging technologies and their use in educational settings.
	Artificial Intelligence and Machine Learning	Their use supports cluster design, personalized learning, adaptive assessments, and predictive analytics for student success.
	Virtual and Augmented Reality	VR and AR are used to create immersive learning environments for simulations, practical applications, and collaborative projects in both online and in-presence activities.
	Learning Analytics	It provides insights at the module, cluster, and program levels, informing decision-making and quality assurance and allows the creation of LA Dashboards to visualize data and process directly.
	Equity and Inclusion	ECOBI fosters access to necessary technologies for diverse student needs to prevent the digital divide.
Roles	Teachers	Teachers design, collaborate, and deliver programs on a competency-based and student-based approach that requires a rethinking of their skills and tasks.
	System Tutors (Instructional Designers)	They guide and support faculty in module design and effective use of educational technologies.
	Disciplinary Tutors	They: • engage with students, maintain regular communication, and foster a supportive learning environment; • create and manage e-tivities; • conduct at least 1 hour per week of online tutoring and support during in-person sessions; • monitor student performance and provide feedback.
	Application Managers and Media Producers	Technicians take care of digital and cloud environments, produce videos and other educational content, and support students and faculty in the use of teaching tools.
Quality Assurance	Standardization	Standardization in clusters and micro-design elements foster the monitoring of good and effective practices.
	Work Team	A panel of professionals works in the production of degree courses, assuring that each phase results compliant with ECOBI key elements.
	Professional Development/ Knowledge building	Faculty, technicians, ID, and tutors receive regular training in blended learning, competency-based instruction, and educational technologies.
	Continuous Improvement	Regular monitoring aligns educational practices with ECOBI guidelines.
	Data Privacy	Data Privacy process that ensures the confidentiality and security of student data collected through AI and analytics tools are planned in ECOBI model.

4. Advantages of ECOBI model for students, teachers, institutions, labor market and society

The ECOBI model offers significant advantages to various stakeholders, including students, teachers, institutions, the whole society, and the labor market.

By integrating emerging technologies into its core components, the ECOBI model not only addresses the immediate educational needs but also prepares students, faculty, and institutions for the future trying to remain at the forefront of educational innovation and the evolving demands of the 21st-century landscape.

For Students

Students in the ECOBI model experience a personalized learning pace, increased engagement (Kahu, 2013; Chen et al., 2010; Henrie et al., 2015), skill recognition, networking, and collaboration.

They benefit from flexible pathways, competency-based design, AI-driven adaptive learning systems that cater to individual needs.

Micro-lectures, interactive e-tivities, immersive VR/AR experiences, and supportive tutoring may increase their motivation and engagement.

Open Badges and Milestone Open Badges formally acknowledge skills, allowing students easy sharing on professional platforms and enhancing employability.

In the blended intensive approach, students build relationships with peers and faculty (potentially also from different institutions), facilitated by collaborative projects and virtual environments beyond geographical and physical limitations.

For Teachers

Instructors in the ECOBI model can benefit of professional development, collaborative opportunities, support structures.

They participate in knowledge building training on modern instructional strategies and educational technologies with colleagues involved in the same teaching process and enhance their teaching and digital skills.

Working with peers (also across institutions) fosters professional growth, the exchange of ideas and collaborative research.

For Institutions

For institutions, adopting the ECOBI model means improving quality and resource efficiency. Shared materials, technological infrastructure, and tutoring roles optimize resources and reduce costs (McGill et al., 2014; Abdekhoda & Dehnad, 2023).

Teachers participating in training acquire skills that strengthen the university's human capital and collaboration among colleagues and other professional figures creates opportunities for innovative and interdisciplinary research and curriculum development.

Collaborative efforts and the adoption of an innovative model enhance the reputation and attract students and faculty.

For Society and Labor Market

ECOBI aims to train competent graduates, cultivate skills aligned with society's needs on labor and citizenship issues, and improve innovation and flexibility in education to increase the number of students entering tertiary education.

Competency-based design and the integration of emerging technologies ensure relevance to current market demands (Ehlers & Kellermann, 2019) and empower students to carry out autonomous and collaborative activities by cultivating a sense of community and responsibility. Graduates trained with advanced technologies on hard and soft skills can bring valuable perspectives to organizations and society.

Open badges system provides detailed insights into students' skills, facilitating better profile recognition.

5. Conclusions

The ECOBI model embodies several distinctive characteristics that collectively enhance the educational experience and align with contemporary and global educational trends by integrating Educational Clusters, the Blended Intensive approach, competency-based design, micro-design elements, and the use of Open Badges. These characteristics are deeply intertwined with the integration of emerging technologies, fostering a modern and effective university education.

It effectively responds to the demand for flexibility, personalization, and relevance in higher education.

The model is inherently scalable and adaptable. It can expand to include more programs, partnerships, and networks, adapt to different disciplines, introduce new perspectives and continuous improvement based on ongoing research and feedback from stakeholders.

While ECOBI presents significant advantages for different categories as described in the paper, implementing such a comprehensive model requires careful consideration of potential challenges:

- resource allocation: developing high-quality online materials, training tutors and teachers, and maintaining technological infrastructure necessitates investment that institutions and governments must allocate.
- faculty engagement: encouraging faculty to adopt new teaching methods and participate in collaborative curriculum design requires institutional support and incentives.

- quality assurance: providing robust quality assurance mechanisms, data protection, regular evaluations, standardization of practices, and feedback loops.
- accessibility, and inclusivity: institutions need to assume responsibility for students with difficulties, such as disabilities and economic restraints, to provide equal educational opportunities for all.

The ECOBI model represents a holistic approach to reimagining higher education for institutions seeking to enhance the relevance and effectiveness of their educational offerings, by prioritizing students and contributing meaningfully to the advancement of the 21st-century society.

Acknowledgments

EDUNEXT (Project Name DEH2023-00003; Single Project Code - CUP: E83C23003480007) is financed by National Recovery and Resilience Plan (NRP), Mission 4 “Education and research” - Component 1 “Strengthening the provision of education services: from creches to universities”, Investment 3.4 “Advanced university teaching and skills”, Sub-investment 3 “Digital Education Hub”, funded by the European Union – NextGenerationEU, referred to Directorial Decree No. 2100 of Dec. 15, 2023.

The collaboration and joint efforts of the community that conceived EDUNEXT contributed to the development of the ECOBI model, as presented in this paper. Over the past two years, representatives and experts from universities and partners have worked together, sharing their experiences in online education and their vision of future university education. All of them contributed with insights, ideas, and reflection.

Authors contributions

According to CRediT system: Tommaso Minerva: Conceptualization, Methodology, Supervision, Project Administration, Writing - Original Draft; Annamaria De Santis: Resources, Visualization, Writing - Review and Editing; Katia Sannicandro: Resources; Claudia Bellini: Resources.

References

Abdekhoda, M., & Dehnad, A. (2023). Effective organizational factors in adopting e-Learning in education: extracting determinants and frameworks. *Journal of E-Learning and Knowledge Society*, *19*(4), 1-8. https://doi.org/10.20368/1971-8829/1135669

Ait Baha, T., El Hajji, M., Es-Saady, Y., & Fadili, H. (2024). The impact of educational chatbot on student learning experience. *Education and Information Technologies*, *29*(8), 10153-10176.

Akçapınar, G., Altun, A., & Aşkar, P. (2019). Using learning analytics to develop early-warning system for at-risk students. *International Journal of Educational Technology in Higher Education*, 16(1), 40.

Baran, E., Correia, A.-P., & Thompson, A. (2011). Transforming online teaching practice: Critical analysis of the literature on the roles and competencies of online teachers. *Distance Education*, 32(3), 421-439.

Barrett, H. C. (2007). Researching electronic portfolios and learner engagement: The REFLECT Initiative. *Journal of Adolescent & Adult Literacy*, 50(6), 436-449.

Bates, A. W. (2022). *Teaching in a Digital Age: Guidelines for Designing Teaching and Learning* (3a ed.). Vancouver, BC: Tony Bates Associates Ltd. Retrieve from: https://pressbooks.bccampus.ca/teachinginadigitalagev3m/

Bellini, C., De Santis, A., Sannicandro, K., & Minerva, T. (2019). Data management in Learning Analytics: terms and perspectives. *Journal of E-Learning and Knowledge Society*, *15*(3), 135-144. https://doi.org/10.20368/1971-8829/1135021

Beke, E., Horvath, R., & Takacsne, G.K. (2020). Industry 4.0 and Current Competencies. *Naše gospo- darstvo/Our Economy*, *66*(4), 63-70.

Biggs, J., & Tang, C. (2011). *Teaching for Quality Learning at University* (4th ed.). Maidenhead: Open University Press.

Billinghurst, M., Clark, A., & Lee, G. (2015). A survey of augmented reality. Foundations and Trends® in Human–Computer Interaction, 8(2-3), 73-272.

Bonk, C. J., & Graham, C. R. (Eds.). (2012). *The Handbook of Blended Learning: Global Perspectives, Local Designs*. San Francisco, CA: Pfeiffer Publishing.

Borup, J., Graham, C. R., Short, C., & Shin, J. K. (2022). Designing the new normal: Enable, engage, elevate, and extend student learning. *EDUCAUSE*

Review. https://er.educause.edu/articles/2022/1/designing-the-new-normal-enable-engage-elevate-and-extend-student-learning

Bower, M., Dalgarno, B., Kennedy, G.E., Lee, M.J.W., & Kenney, J. (2015). Design and implementation factors in blended synchronous learning environments: Outcomes from a cross-case analysis. *Computers & Education*, *86*, 1-17.

Brame, C. J. (2016). Effective educational videos: Principles and guidelines for maximizing student learning from video content. *CBE-Life Sciences Education*, 15(4), es6.

Carey, K., & Stefaniak, J. (2018). An exploration of the utility of digital badging in higher education settings. *Educational Technology Research and Development*, 66(5), 1211-1229.

Cedefop (2023). *Microcredentials for labour market education and training: microcredentials and evolving qualifications systems*. Luxembourg: Publications Office.

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *IEEE Access*, 8, 75264-75278.

Chen, P.S.D., Lambert, A.D., & Guidry, K.R. (2010). Engaging online learners: The impact of Web-based learning technology on college student engagement. *Computers & Education*, *54*(4), 1222-1232.

Clements, K., West, R. E., & Hunsaker, E. (2020). Getting started with open badges and open microcredentials. *International Review of Research in Open and Distributed Learning*, *21*(1), 154-172.

De Santis, A., Bellini, C., Jana, M., Righetti, L., Sannicandro, K., Talha, M., & Minerva, T. (2024). Dashboards for admins, teachers, and students: tools for monitoring and learning. *EDULEARN24 Proceedings* (pp. 4666-4672). IATED.

De Santis, A., Sannicandro, K., Bellini, C., & Minerva, T. (2023). Analysis of MOOC Features in a Regional Platform: Design and Delivery of Courses. In *International Workshop on Higher Education Learning Methodologies and Technologies Online* (pp. 30-43). Cham: Springer Nature Switzerland.

Drachsler, H., & Greller, W. (2016). Privacy and analytics: It's a DELICATE issue-a checklist for trusted learning analytics. In *Proceedings of the Sixth International Conference on Learning Analytics & Knowledge* (pp. 89-98).

Ehlers, U.-D., & Kellermann, S. A. (2019). Future Skills-The Future of Learning and Higher Education. *Results of the International Future Skills Delphi Survey*. Karlsruhe: Karlsruhe University of Applied Sciences.

Ferguson, R., Hoel, T., Scheffel, M., & Drachsler, H. (2016). Guest editorial: Ethics and privacy in learning analytics. *Journal of Learning Analytics*, 3(1), 5-15.

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education*, 7(2), 95-105.

Garrison, D. R., & Vaughan, N. D. (2008). Blended Learning in Higher Education: Framework, Principles, and Guidelines. San Francisco, CA: Jossey-Bass.

Gish-Lieberman, J. J., Tawfik, A., & Gatewood, J. (2021). Micro-credentials and badges in education: A historical overview. *TechTrends*, 65, 5-7.

Graham, C. R. (2013). Emerging practice and research in blended learning. In *Handbook of Distance Education* (3rd ed., pp. 333-350). New York, NY: Routledge.

Graham, C. R., & Draper, D. E. (n.d.). Blended Teaching. *The Open Encyclopedia of Educational Technology*. Retrieved from https://edtechbooks.org/encyclopedia/blended_teaching

Guo, P. J., Kim, J., & Rubin, R. (2014). How video production affects student engagement: An empirical study of MOOC videos. In *Proceedings of the first ACM conference on Learning@ scale conference* (pp. 41-50).

Guo, P., Saab, N., Post, L.S., & Admiraal, W. (2020). A review of project-based learning in higher education: Student outcomes and measures. *International journal of educational research*, *102*, 101586.

Halupa, C. (2019). Differentiation of Roles: Instructional Designers and Faculty in the Creation of Online Courses. *International Journal of Higher Education*, 8 (1), 55-68.

Han, X., Cui, Y., Wang, W., Wang, S., & Feng, X. (2023). Implementation of Blended Learning at the Course Level. In *Handbook of Educational Reform Through Blended Learning* (pp. 45-123). Singapore: Springer Nature Singapore.

Helleken, T., Langesee, L.M., & Jantos, A. (2024). Bridging the gap: a guide for competence improvement methods for e-tutors in higher education. In *EDULEARN24 Proceedings* (pp. 304-313). IATED.

Henrie, C.R., Halverson, L.R., & Graham, C.R. (2015). Measuring student engagement in technology-mediated learning: A review. *Computers & Education*, *90*, 36-53.

HolonIQ (2023). *Micro-credentials Survey. 2023 Trends and Insights*. Retrieved from https://www.holoniq.com/notes/micro-credentials-survey-2023-insights

Hrastinski, S. (2019). What do we mean by blended learning? *TechTrends*, 63(5), 564-569.

Ifenthaler, D., & Yau, J. Y.-K. (2020). Utilising learning analytics to support study success in higher education: A systematic review. *Educational Technology Research and Development*, 68(4), 1961-1990.

Ilieva, G., Yankova, T., Klisarova-Belcheva, S., Dimitrov, A., Bratkov, M., & Angelov, D. (2023). Effects of generative chatbots in higher education. *Information*, *14*(9), 492.

Iniesto, F., Ferguson, R., Weller, M., Farrow, R., & Pitt, R. (2022). Introducing a reflective framework for the assessment and recognition of microcredentials. *The Open/Technology in Education, Society, and Scholarship Association Journal*, *2*(2), 1-2 4.

Jensen, L., Konradsen, F., & Nielsen, C. (2019). A review of the use of virtual reality head-mounted displays in education and training. *Education and Information Technologies*, 24(1), 151-158.

Johnson, D. W., Johnson, R. T., & Smith, K. A. (2014). Cooperative learning: Improving university instruction by basing practice on validated theory. *Journal on Excellence in College Teaching*, 25(3&4), 85-118.

Kahu, E. R. (2013). Framing student engagement in higher education. *Studies in Higher Education*, 38(5), 758-773.

Knight, S., Shum, S. B., & Littleton, K. (2014). Epistemology, assessment, pedagogy: Where learning meets analytics in the middle space. *Journal of Learning Analytics*, 1(2), 23-47.

Kossen, C., & Ooi, C.Y. (2021). Trialling micro-learning design to increase engagement in online courses. *Asian Association of Open Universities Journal*, *16*(3), 299-310.

Koszalka, T.A., RussEft, D.F., & Reiser, R. (2013). *Instructional designer competencies: The standards*. IAP.

Labadze, L., Grigolia, M., & Machaidze, L. (2023). Role of AI chatbots in education: systematic literature review. *International Journal of Educational Technology in Higher Education*, *20*(1), 56.

Laferrière, T., Lamon, M., & Chan, C. K. K. (2006). Emerging e-trends and models in teacher education and professional development. *Teaching Education*, 17(1), 75-90.

Lang, C., Siemens, G., Wise, A.F., Gašević, D., & Merceron, A. (2022) (Eds.). *Handbook of Learning Analytics* (2nd. ed.). Vancouver: SoLAR.

Langesee, L.M. (2023). From qualification to competencies: defining a task-based competency profile for e-tutors in higher education. *International Journal of Management in Education*, *17*(2), 109-129.

Li, S., Zhang, J., Yu, C., & Chen, L. (2017). Rethinking distance tutoring in e-learning environments: A study of the priority of roles and competencies of Open University Tutors in China. *International Review of Research in Open and Distributed Learning*, *18*(2), 189-212.

Liasidou, A. (2014). Critical disability studies and socially just change in higher education. *British Journal of Special Education*, 41(2), 120-135.

Liu, Q., Chen, L., Feng, X., Bai, X., & Ma, Z. (2024). Supporting students and instructors in blended learning. *Handbook of Educational Reform Through Blended Learning*, 199-230.

López-Gómez, E., Leví-Orta, G., Medina Rivilla, A., & Ramos-Méndez, E. (2020). Dimensions of university tutoring: a psychometric study. *Journal of Further and Higher Education*, *44*(5), 609-627.

MacDonald, J. (2008). *Blended learning and online tutoring: Planning learner support and activity design*. Gower Publishing, Ltd.

Magruder, O., Arnold, D. A., Moore, S., & Edwards, M. (2019). What Is an ID? A Survey Study. *Online Learning*, *23*(3), 137-160.

Masiello, I., Mohseni, Z., Palma, F., Nordmark, S., Augustsson, H., & Rundquist, R. (2024). A Current Overview of the Use of Learning Analytics Dashboards. *Education Sciences*, *14*(1), 82.

Massuga, F., Soares, S., & Luis Dias Doliveria, S. (2021). El papel del tutor en la enseñanza de la educación a distancia: una revisión sistemática sobre el enfoque de competencias. *Revista de Educación a Distancia* (RED), *21*(66).

McGill, T. J., Klobas, J. E., & Renzi, S. (2014). Critical success factors for the continuation of e-learning initiatives. *The Internet and Higher Education*, 22, 24-36.

Means, B., Toyama, Y., Murphy, R., & Bakia, M. (2013). The effectiveness of online and blended learning: A meta-analysis of the empirical literature. Teachers College Record, 115(3), 1-47.

Minerva, T., Jana, M., Bellini, C., De Santis, A., & Sannicandro, K. (2022). Openess in education: A technological and conceptual framework. In *EDULEARN22 Proceedings* (pp. 4521-4526). IATED.

Popenici, S. A. D., & Kerr, S. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. *Research and Practice in Technology Enhanced Learning*, 12(1), 22.

Prince, M. (2004). Does active learning work? A review of the research. *Journal of engineering education*, 93(3), 223-231.

Qureshi, M. A., Khaskheli, A., Qureshi, J. A., Raza, S. A., & Yousufi, S. Q. (2023). Factors affecting students' learning performance through collaborative learning and engagement. *Interactive Learning Environments*, *31*(4), 2371-2391.

Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2020). A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers & Education*, 147, 103778.

Ramaswami, G., Susnjak, T., & Mathrani, A. (2023). Effectiveness of a Learning Analytics Dashboard for Increasing Student Engagement Levels. *Journal of Learning Analytics*, *10* (3), 115-134.

Reiser, R. A., & Dempsey, J. V. (Eds.). (2017). *Trends and Issues in Instructional Design and Technology* (4th ed.). Boston, MA: Pearson.

Salmon, G. (2013). *E-tivities: The Key to Active Online Learning* (2nd ed.). New York, NY: Routledge.

Sannicandro, K., De Santis, A., Bellini, C., & Minerva, T. (2019). Analysis of completion and dropout rates in EduOpen MOOCs. *Italian Journal of Educational Research*, 27-42.

Schwendimann, B.A., Rodriguez-Triana, M.J., Vozniuk, A., Prieto, L.P., Boroujeni, M.S., Holzer, A., Gillet, D., & Dillenbourg, P. (2017). Perceiving Learning at a Glance: A Systematic Literature Review of Learning Dashboard Research. I*EEE Transactions on Learning Technologies*, *10*(1), 30-41.

Selwyn, N. (2014). *Digital Technology and the Contemporary University: Degrees of Digitization*. New York, NY: Routledge.

Slade, S., & Prinsloo, P. (2013). Learning analytics: Ethical issues and dilemmas. *American Behavioral Scientist*, 57(10), 1510-1529.

Staring, F., Brown, M., Bacsich, P., & Ifenthaler, D. (2022). Digital higher education: Emerging quality standards, practices and supports. *OECD Education Working Papers*, No. 281, OECD Publishing, Paris.

Stephany, F., & Teutloff, O. (2024). What is the price of a skill? The value of complementarity. *Research Policy*, *53*(1), 104898.

Stensaker, B. (2018). Academic development as cultural work: Responding to the organizational complexity of modern higher education institutions. *International Journal for Academic Development*, 23(4), 274-285.

Suhasini, B., & Santhosh Kumar, N. (2019). Emerging trends and future perspective of human resource reskilling in higher education. *International Journal of Recent Technology and Engineering*, *8*(2), 351-353.

Tomlinson, M. (2017). Forms of graduate capital and their relationship to graduate employability. *Education + Training*, 59(4), 338-352.

Vegliante, R., & Sannicandro, K. (2020). The role of the tutor in the university context and in distance learning: an exploratory research. *Journal of E-Learning and Knowledge Society*, *16*(3), 76-85. https://doi.org/10.20368/1971-8829/1135274

Verbert, K., Duval, E., Klerkx, J., Govaerts, S., & Santos, J.L. (2013). Learning analytics dashboard applications. *American Behavioral Scientist*, *57*(10), 1500-1509.

Vlachopoulos, D., & Makri, A. (2017). The effect of games and simulations on higher education: a systematic literature review. *International Journal of Educational Technology in Higher Education*, *14*, 1-33.

Wiggins, G., & McTighe, J. (2005). *Understanding by Design* (2nd ed.). Alexandria, VA: ASCD.

Willis, J. E., Slade, S., & Prinsloo, P. (2016). Ethical oversight of student data in learning analytics: A typology derived from a cross-continental, cross-institutional perspective. *Educational Technology Research and Development*, 64(5), 881-901.

Yorke, M. (2006). Employability in higher education: What it is-What it is not. *Learning and Employability Series One*. York: Higher Education Academy.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory Into Practice*, 41(2), 64-70.