Leading Immersive Educational Excellence: Management of Innovation, Quality Assurance, and Humanistic Digital Transformation in European Education

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Abstract. The expansion of virtual reality, augmented reality, extended reality and metaverse-related environments has intensified debate about their capacity to transform contemporary educational processes. However, immersive technologies do not produce educational excellence by themselves. Their value depends on the institutional capacity to integrate them within coherent strategies of leadership, pedagogical design, quality assurance, evaluation, sustainability and ethical governance. This chapter adopts a conceptual approach anchored in the European MUST project (Metaverse for Upskilling and Social Transformation) as an illustrative case to examine how immersive technologies can contribute to educational excellence when managed from a strategic and humanist perspective. On this basis, the chapter proposes an Ecosystemic Leadership Model for Immersive Educational Excellence, articulating distributed digital leadership, immersive pedagogical design, multidimensional engagement, evidence-based quality assurance, institutional scalability, ethical governance and the creation of educational and social value. The chapter concludes that immersive ecosystems only produce sustainable educational transformation when embedded within robust systems of leadership, quality, institutional learning and continuous improvement.

Keywords: Educational Leadership, Immersive Learning, Extended Reality, Educational Metaverse, Innovation Management.

1 Introduction

Digital transformation has substantially altered the ways in which educational institutions design, implement and evaluate teaching and learning. Within this context, immersive technologies — virtual reality (VR), augmented reality (AR), extended reality

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(XR) and persistent virtual environments associated with the metaverse — have gained considerable prominence in discussions about educational innovation, student engagement and future-oriented competence development.

The research literature suggests that these technologies can support motivation, contextualised practice and experiential learning [1,2,3]. Studies in higher education and vocational training point to their potential for complex simulation and situated competence development [4,5]. At the same time, the available evidence consistently identifies constraints related to accessibility, sustainability, scalability, privacy and institutional governance [6,7].

A significant share of this literature, however, remains focused on didactic effectiveness, technology acceptance or student satisfaction. By contrast, far fewer studies integrate educational leadership, innovation management, quality assurance, organisational learning and institutional transformation as the conditions under which immersive innovation becomes sustainable. This gap reflects a structural tendency to evaluate immersive technologies as instruments rather than as components of organisational systems that require governance.

This tendency is particularly visible in the European context. The Digital Education Action Plan 2021–2027 [8], DigCompEdu [9], DigCompOrg [10] and the Ethical Guidelines on Artificial Intelligence in Education [11] share a common premise: digital transformation in education cannot be reduced to the adoption of tools. It is a process of institutional transformation involving leadership, strategy, evaluation, inclusion and ethical governance. Immersive technologies are no exception to this logic.

The originality of this chapter lies in shifting the analytical focus from technological adoption to the institutional capacity required to convert immersive technologies into sustainable ecosystems of learning, innovation and educational excellence. The chapter uses the MUST project as an illustrative case — not as the empirical basis for the model, but as a concrete European experience that makes visible the organisational and pedagogical questions the model is designed to address. The principal contribution is the Ecosystemic Leadership Model for Immersive Educational Excellence, proposed as a conceptual framework for orienting institutional strategy, design, evaluation and governance of immersive learning environments. Only two levels of headings should be numbered. Lower level headings remain unnumbered; they are formatted as run-in headings.

2 Educational Leadership and Digital Immersive Transformation

The growing complexity of digital educational ecosystems has repositioned leadership as a central variable in understanding contemporary educational innovation. Institutions no longer face simply the challenge of incorporating technologies; they must manage organisational, pedagogical and cultural transformations that affect both teaching and learning processes and institutional governance.

Transformational leadership remains one of the most relevant frameworks for understanding institutional capacity to mobilise change. Burns [12] and Bass [13] argue

that effective leadership involves shared vision, intellectual stimulation, collective commitment and strategic orientation towards improvement. Applied to immersive contexts, this framework clarifies why technological innovation acquires educational value only when embedded in an institutional strategy oriented to learning and continuous improvement — and why, absent such a strategy, even technically sophisticated environments tend to produce superficial engagement.

Distributed leadership extends this argument by emphasising that sustainable educational innovation does not depend solely on individual directive figures but on collaborative dynamics capable of integrating teachers, coordinators, technical teams, students and external actors [14]. Immersive experiences require precisely this co-creation logic: pedagogical, organisational and technological decisions are distributed across multiple levels rather than concentrated in a single role.

Leadership for learning adds a further dimension: the institutional capacity to create conditions that favour professional development, organisational learning and educational improvement [14]. Leading immersive processes means generating institutional cultures open to experimentation, critical reflection and sustainable innovation — not merely securing technology budgets or arranging training sessions.

Digital leadership presents particular conceptual challenges. Jameson et al. [15] identify limited theoretical maturity in higher education, where approaches remain frequently technocentric, conflating infrastructure management with genuine digital leadership. This chapter understands digital leadership as the institutional capacity to align technology, pedagogy, ethics, data, governance and educational strategy within coherent processes of transformation. An institution can achieve high digital infrastructure scores on DigCompOrg metrics while exhibiting weak digital leadership if alignment between these dimensions is absent.

Immersive leadership can be defined as the institutional capacity to design, implement, evaluate and scale immersive experiences coherent with educational objectives, institutional quality standards and the creation of social value. This definition deliberately resists reduction to technology management: it insists that the questions driving immersive innovation must be pedagogical and institutional before they are technological.

3 Methodological Approach: Conceptual Chapter with Illustrative Case

This chapter adopts a conceptual approach that uses the MUST project as an illustrative case. It is not structured as an empirical study, and the model proposed does not derive from the case in any inductive or validatory sense. The MUST experience functions as a reference point that makes concrete the organisational and pedagogical challenges the model is designed to address, giving the conceptual argument a European institutional anchorage without claiming empirical validation.

This distinction is methodologically important. Conceptual chapters that claim more than an illustrative function for their cases invite scrutiny that purely theoretical contributions would not face. By clarifying this relationship upfront, the chapter can use

MUST precisely where it is genuinely informative — as an example of the tensions and conditions the model theorises — without overstating its evidential weight.

The analysis combines three complementary levels: (1) a conceptual and theoretical review of educational leadership, digital leadership, immersive learning, engagement, educational quality, organisational learning and digital transformation; (2) an analytical rereading of MUST as a European living lab of immersive educational innovation; and (3) the construction of a conceptual model explaining how immersive technologies can contribute to educational excellence when integrated within coherent institutional strategies.

The MUST project involved 264 students and teachers from Spain, Italy and Romania in activities related to XR experiences, immersive simulations, collaborative scenarios and contextualised practices. The project assessed five dimensions — contextual sensitivity, creativity, conceptual knowledge, coherence and critical reflection — which this chapter reinterprets from an institutional and ecosystemic perspective, treating them not as learning variables to be validated but as organisational indicators illuminating the broader challenge of leading, evaluating and scaling immersive experiences.

The approach has acknowledged limitations. The model has not been empirically validated through longitudinal or comparative research, and its dependence on a single illustrative case restricts the diversity of institutional contexts from which it draws. These limitations are addressed in Sect. 11.

4 Immersive Learning, Engagement and Experiential Education

Immersive technologies have substantially expanded the possibilities for designing active, contextualised and interactive educational experiences. VR enables complex simulations and safe practice environments; AR connects digital information with physical scenarios; XR and persistent virtual environments support collaboration, social interaction and situated learning.

These characteristics connect directly with Kolb's experiential learning cycle [16], in which learning emerges through concrete experience, reflection, conceptualisation and experimentation. Lave and Wenger's situated learning [17] is equally relevant: knowledge acquires meaning when constructed in communities of practice and contextualised situations, and immersive ecosystems are particularly well-suited to this form of interaction.

A critical finding in the recent literature is that the educational value of immersive technologies depends less on technological sophistication than on the quality of pedagogical design and curricular integration [4,6]. Investments in hardware and platforms not matched by investment in pedagogical design and institutional support tend to produce the novelty effect — motivational engagement that does not translate into deep learning or competence transfer.

The concept of engagement has become central to this debate. Fredricks et al. [18] distinguish four complementary dimensions: behavioural engagement (participation

and persistence), emotional engagement (motivation, belonging and interest), cognitive engagement (intellectual effort, depth of learning and reflection) and agentic engagement (the learner's capacity to actively influence their own educational experience). Immersive technologies can contribute to all four dimensions, but only when pedagogical design supports meaningful participation, contextualisation, problem-solving and competence transfer rather than mere exposure to a novel medium.

The available evidence also identifies persistent constraints: the novelty effect, cognitive overload, cybersickness, high costs, limited accessibility and a shortage of robust longitudinal studies [1,6,3]. These constitute the institutional reality within which any leadership model for immersive education must operate, and they motivate the focus on governance, quality assurance and scalability developed in Sects. 5 and 7.

5 Innovation Management and Quality Assurance in Immersive Education

One of the central challenges of contemporary educational innovation is the transformation of pilot experiences into sustainable institutional processes. Many digital initiatives generate initial motivation and institutional visibility, then disappear due to weaknesses in governance, teacher training, evaluation or scalability. In the case of immersive technologies this risk is amplified: VR, AR and XR typically imply significant technical investment, curriculum adaptation needs and continuous organisational support.

Innovation management in education requires a systemic logic oriented to institutional learning and continuous improvement. The European ESG 2015 framework [19] and the EFQM model both emphasise that educational excellence requires leadership, strategy, stakeholder participation, evidence generation and sustainable value creation. DigCompOrg [10] similarly underlines that digital transformation requires organisational capacity, collaborative culture and coherent institutional governance — not merely infrastructure investment.

Quality assurance in immersive education cannot be reduced to satisfaction metrics or technology adoption rates. It requires multilevel frameworks evaluating pedagogical coherence, formative impact, institutional sustainability, inclusion, professional transfer and the creation of educational and social value — attending to at least five levels: student learning and engagement; teacher pedagogical competence; institutional sustainability; professional transfer and employability; and cooperation and social impact.

Sakr and Abdullah [7] note that VR, AR and learning analytics can generate useful data on participation, interaction and performance, but that methodological limitations related to interpretation, privacy and comparability persist. This reinforces the argument for frameworks combining multiple indicators rather than relying on single-metric proxies for quality.

Table 1 reinterprets the five MUST assessment dimensions from an institutional quality perspective. The point is not to claim that MUST validated these indicators, but to show how dimensions designed to evaluate learning outcomes can be productively reread as organisational criteria for leading and evaluating immersive innovation.

Table 1. Institutional rereading of the MUST dimensions.

MUST Dimension	Rereading from leadership and quality	Institutional indicator
Contextual sensitivity	Alignment with real institutional needs	Needs diagnosis; contextual adaptation
Creativity	Innovation capacity and problem-solving	Pedagogical design; learning transfer
Conceptual knowledge	Depth and transferability of learning	Competence assessment; professional impact
Coherence	Pedagogical and strategic alignment	Curriculum integration; QA consistency
Critical reflection	Ethical awareness and digital governance	Responsible use; privacy; inclusion

6 MUST as a European Living Lab of Immersive Innovation

The MUST project can be read as a European living lab of immersive innovation. This reading does not require treating MUST as a comprehensive case study; it requires recognising that the project made visible a set of institutional conditions and tensions that purely theoretical accounts of immersive leadership tend to obscure (Table 2).

Living labs are characterised by developing innovation in real contexts through multi-actor participation, co-creation processes and dynamics of experimentation and continuous improvement [20]. In higher education and vocational training, these spaces allow research, pedagogical innovation and organisational transformation to be connected within a single institutional experiment.

MUST's transnational dimension — three countries, heterogeneous institutional contexts, shared assessment indicators — is particularly significant from a leadership perspective. The project created a structure within which institutions had to negotiate pedagogical coherence across different regulatory, infrastructural and cultural conditions, precisely the challenge that distributed leadership frameworks are designed to address.

Specifically, MUST made visible several tensions central to the leadership model developed in Sect. 7: differences in digital infrastructure between partner institutions; heterogeneous levels of teacher competence and confidence with immersive tools; varying institutional cultures regarding experimentation and quality assurance; and the difficulty of sustaining engagement beyond the initial novelty phase. These are the normal conditions under which institutional innovation in immersive education occurs, and they are precisely what a leadership model must account for.

Table 2. MUST as a European living lab of immersive leadership.

Feature of the case	Analytical reading	Institutional implication
Three-country cooperation	Distributed transnational leadership	Multilevel governance

Contextualised XR activities	Situated learning and pedagogical design	Meaningful immersive design
Shared assessment dimensions	Evidence-based quality assurance	Institutional scalability
Infrastructure heterogeneity	Structural constraints on innovation	Equity planning; differentiated support
Critical reflection on technology	Digital humanism	Ethical governance
Feature of the case	Analytical reading	Institutional implication

The value of MUST as an illustrative case lies not in the novelty of its technological resources but in the organisational and pedagogical questions its implementation raises. The model proposed in Sect. 7 can be understood as a conceptual response to precisely these questions.

7 Ecosystemic Leadership Model for Immersive Educational Excellence

This chapter proposes an Ecosystemic Leadership Model for Immersive Educational Excellence. The model rests on a central premise: immersive technologies generate sustainable educational value only when embedded in organisational systems capable of articulating leadership, pedagogy, engagement, evaluation, institutional learning and ethical governance. Its architecture is deliberately ecosystemic — the dimensions form a dynamic system of recursive interactions rather than a checklist of independent components.

In a linear model, leadership produces pedagogical design, which produces engagement, which produces quality outcomes. In an ecosystemic model, each dimension influences and is influenced by the others: evidence generated by quality assurance reconfigures leadership strategy; ethical governance constraints shape pedagogical design choices; organisational learning modifies how engagement is understood and pursued. The model is therefore not a sequence to follow but a structure of interdependencies to manage.

7.1 Distributed Digital Leadership

Leadership occupies the nucleus of the ecosystem. It encompasses strategic vision, institutional governance, distributed coordination and the capacity to mobilise educational innovation. Immersive leadership is not technology management; it is a form of organisational leadership oriented to integrating technology, pedagogy, quality and sustainability across roles — academic directors, pedagogical coordinators, teachers, technical teams and, in contexts of genuine co-creation, students.

7.2 Immersive Pedagogical Design and Alignment

Immersive experiences require coherence between educational objectives, active methodologies, contextualised activities and evaluation systems. Technology acquires meaning when it supports experiential learning, collaboration, problem-solving and competence transfer. The risk of technocentrism — designing around tool capabilities rather than pedagogical objectives — is real and persistent, as the literature on the novelty effect consistently demonstrates [1,3].

7.3 Multidimensional Engagement

Engagement is conceived as a complex category integrating behavioural, emotional, cognitive and agentic dimensions [18]. The risk of confusing emotional engagement (enthusiasm for a novel medium) with cognitive engagement (intellectual effort and reflective depth) must be continuously managed through pedagogical design and quality assurance.

7.4 Evidence-Based Quality Assurance

Immersive innovation requires evaluation systems generating useful evidence for decision-making and continuous improvement — combining indicators of learning, inclusion, sustainability, satisfaction, transfer and employability. The ESG [19] and EFQM frameworks provide a structural basis for this multilevel approach, while learning analytics tools offer increasing capacity to generate fine-grained evidence, subject to the governance constraints identified by Sakr and Abdullah [7].

7.5 Organisational Learning and Institutional Scalability

The sustainability of innovation depends on the institutional capacity to document experiences, share knowledge, develop teacher competence and transfer organisational learning across contexts [21,22]. Scalability is a process of institutional learning rather than merely technical expansion. Institutions that treat scaling as replication typically reproduce the limitations of the original pilot rather than its strengths.

7.6 Ethical Governance and Digital Humanism

Digital immersive transformation raises questions about accessibility, privacy, data protection, digital wellbeing, inclusion and responsible use of digital identity. The UNESCO frameworks [23,24] and the European Commission's ethical guidelines [11] insist that the value of educational technology must be assessed against criteria of human dignity, equity and social responsibility.

7.7 Educational Excellence and Social Value Creation

Immersive educational excellence is expressed through meaningful learning, employability, pedagogical innovation, institutional cooperation and sustainable social value creation. It is not a technological outcome but an organisational and pedagogical one: the ultimate measure of an immersive ecosystem's success is not the sophistication of its tools but the quality of the educational and social outcomes it produces (Table 3).

Table 3. Operationalisation of the Ecosystemic Leadership Model.

Dimension	Theoretical basis	Indicators	Associated risks
Distributed digital leadership	Bass [13]; Jameson et al. [15]; Leithwood et al. [14]	Strategic vision; governance; coordination	Institutional fragmentation
Immersive pedagogical design	Kolb [16]; Lave & Wenger [17]	Curricular coherence; situated learning	Technocentrism
Multidimensional engagement	Fredricks et al. [18]	Participation; agency; cognitive involvement	Novelty effect
Evidence-based QA	ESG [19]; EFQM	Multilevel evaluation; learning analytics	Superficial evaluation
Organisational learning & scalability	Nonaka [21]; Rogers [22]	Transfer; institutionalisation	Resource dependency
Ethical governance & humanism	UNESCO [23,24]; EC [11]	Inclusion; privacy; accessibility	Digital divide
Educational excellence & social value	Systemic leadership	Educational impact; employability	Superficial innovation

8 Risks, Tensions and Ethical Governance

Immersive technologies present significant opportunities for educational transformation, but they also generate risks and tensions that require critical analysis. Addressing these seriously is a precondition for building leadership models that function in real institutional conditions rather than idealised ones.

The novelty effect is the best-documented risk: initial student motivation driven by the innovative character of the immersive experience does not consistently translate into deep learning or meaningful competence transfer [1,3]. This risk is manageable through pedagogical design, but only if institutions build quality assurance systems capable of distinguishing emotional from cognitive engagement.

The digital divide and unequal access represent a structural risk. Immersive technologies typically require specific devices, connectivity, technical support and advanced

digital competences. When these are not equitably available — within an institution, across partner institutions or across student populations — innovation can amplify existing educational inequalities.

Privacy and data governance present a qualitatively distinct risk. XR ecosystems can collect sensitive information about behaviour, movements, digital identity and user interaction, raising ethical questions about transparency, data protection and responsible governance that go beyond compliance [11,23].

Institutional sustainability is a risk that affects even technically successful pilots. An immersive experience can achieve strong outcomes during a funded project phase and prove unsustainable beyond it due to high costs, technological dependency or the absence of strategic planning. Scalability planning must therefore begin at the design stage, not after pilot completion.

Finally, technosolutionism — the assumption that technology constitutes an automatic solution to complex educational problems — remains a persistent institutional risk. When innovation is organised around tools rather than learning objectives, the result is typically pedagogical superficiality: engagement without depth, participation without transfer, novelty without meaning (Table 4).

Table 4. Risks of immersive innovation and institutional responses.

Risk	Potential consequence	Institutional response
Novelty effect	Superficial motivation without learning transfer	Pedagogically grounded design; longitudinal evaluation
Digital divide	Exclusion and amplification of inequalities	Equitable access planning; differentiated support
Accessibility gaps	Limited participation by diverse learners	Universal design; inclusive pedagogy
Privacy and data	Ethical risks; trust erosion	Digital governance; transparency protocols
High costs	Low institutional sustainability	Strategic planning from design stage
Institutional fragmentation	Isolated pilots; no organisational learning	Distributed leadership; documentation systems

9 Discussion: Theoretical, Practical and European Contributions

9.1 Theoretical Contribution

The principal theoretical contribution of this chapter is the integration of educational leadership, digital leadership, immersive learning, quality assurance and organisational learning within a single ecosystemic framework oriented to educational excellence. Existing models tend to address these dimensions separately: leadership scholarship rarely

engages with the specific conditions of immersive environments; immersive learning research rarely addresses institutional governance and quality; quality assurance frameworks rarely theorise leadership in relation to emerging technologies.

The Ecosystemic Leadership Model addresses this fragmentation by proposing a structure of interdependencies rather than a hierarchy of factors. Its dynamic, recursive architecture departs from models that treat leadership as an input and excellence as an output, insisting instead that the relationship between these dimensions is constitutively interactive.

9.2 Practical Contribution

From a practical perspective, the chapter offers dimensions and indicators useful for designing, evaluating and scaling immersive experiences in higher education and vocational training. The model can support institutional processes related to strategic planning, immersive pedagogical design, quality assurance, evidence-based evaluation, teacher development, digital governance and institutional sustainability. The reinterpretation of the MUST dimensions (Table 1) illustrates how indicators designed for individual learning assessment can be reframed as organisational criteria for institutional quality.

9.3 European Contribution

In European terms, the chapter reinterprets MUST as a transnational living lab aligned with educational digitalisation, institutional cooperation, employability and humanist digital transformation. The MUST experience illustrates how transnational projects can function as ecosystems of organisational learning, generating not only pedagogical outcomes but also governance knowledge transferable across different institutional contexts [8,9,10].

10 Implications for Institutional Leadership

The reflections developed in this chapter carry specific implications for universities, vocational training centres, leadership teams, innovation officers and coordinators of European projects.

First, the incorporation of immersive technologies requires a strategic logic oriented to concrete educational needs. Technology selection makes sense only when linked to pedagogical objectives, competence development goals and institutional contexts — not when driven by funding availability or the visibility of technological trends.

Second, teacher development occupies a central position in immersive transformation processes. Beyond technical proficiency, relevant competences include pedagogical design, formative evaluation, ethical sensitivity and the organisational capacity to sustain educational innovation through cycles of reflection and adjustment.

Third, evaluation must occupy a structural — not supplementary — position within immersive ecosystems. Institutions benefit from frameworks combining indicators of

learning, engagement, inclusion, professional transfer, sustainability and institutional quality, capable of distinguishing the novelty effect from genuine educational impact.

Fourth, scalability requires planning from the initial stages of innovation. Documentation, organisational learning, institutional coordination and distributed governance are relevant factors for transforming pilot experiences into sustainable strategies, a process that Rogers' diffusion framework [22] helps structure but that requires institutional leadership to execute.

Finally, European projects can serve as spaces of institutional learning and transnational cooperation, provided that the governance infrastructure for capturing and transferring this knowledge is deliberately built into the project design.

11 Limitations and Future Research Directions

This chapter has several limitations that must be acknowledged. The proposed model has not been empirically validated through longitudinal or comparative studies. Its use of a single illustrative case restricts the diversity of institutional contexts from which it draws. The literature on immersive leadership and quality assurance in XR contexts remains emergent, limiting the consolidation of fully stabilised conceptual frameworks.

Future research could productively pursue the following directions: empirical validation of the model in diverse educational contexts; comparative analysis of European immersive ecosystems; examination of immersive leadership through learning analytics; study of the impact of XR on employability and professional transfer; investigation of the ethical governance and regulation of immersive ecosystems; and exploration of the relationships between artificial intelligence, the metaverse and educational quality [25,5].

A particularly important gap concerns the relationship between immersive leadership and organisational culture. The model proposes distributed leadership as a condition for sustainable innovation, but the conditions under which distributed leadership emerges and is maintained in heterogeneous institutional contexts remain undertheorised. Longitudinal case studies could make a significant contribution here.

12 Conclusions

Immersive technologies represent a genuine opportunity for contemporary educational transformation, particularly in contexts where education must respond to new demands for competence, employability, participation and meaningful learning. But the case for optimism is organisational, not technological.

Virtual reality, augmented reality and metaverse-related environments do not produce educational excellence by themselves. Their value depends on the institutional capacity to embed them within coherent systems of leadership, pedagogical design, quality assurance, evaluation and ethical governance. The MUST project illustrates — as one European case among many possible ones — how an immersive initiative can become a laboratory of organisational learning and institutional innovation when governed from a logic of distributed leadership and continuous improvement.

The Ecosystemic Leadership Model proposed in this chapter offers a conceptual basis for orienting future institutional strategies for sustainable and humanist immersive innovation. Its seven dimensions — distributed digital leadership, immersive pedagogical design, multidimensional engagement, evidence-based quality assurance, organisational learning, ethical governance and social value creation — are not a formula to be implemented mechanically. They are an analytical structure for the questions that institutions must ask and answer if immersive technologies are to produce educational transformation rather than educational spectacle.

The debate about immersive technologies in education should not centre primarily on which devices or platforms to adopt. It should centre on what institutional capacities allow those technologies to be converted into sustainable, inclusive and socially valuable educational experiences. Immersive educational excellence is not a technological achievement. It is an organisational construction, built on leadership, quality, institutional learning and ethical governance.

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