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From Consensus to Action: A Delphi Follow-Up Panel to Operationalized the ILM Integration Framework for Responsible Immersive Learning in Higher Education

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Abstract. Building on the iLRN2024 panel, "Interactive & Immersive Learning Media in Higher Education – XR and Beyond," this session explores the advancements initiated through the application of Delphi framework. This method facilitated expert input on challenges, opportunities, and best practices for integrating Interactive and Immersive Learning Media (ILM) in higher education. Panelists will discuss outcomes following this systematic approach that addressed themes like XR adoption barriers, interdisciplinary innovation, and ethical design. Topics include strategic visions, impactful design principles, and future trends shaping ILM. Attendees will gain actionable insights for implementing immersive technologies in education.

Keywords: Immersive Learning Media, XR, Delphi, Fuzzy Delphi, Higher Education, AI-Enabled Immersive Learning, Governance, Accessibility, Sustainability, Assessment, Implementation Frameworks.

1 Context and Rationale

Immersive Learning Media (ILM)—including VR/AR/MR, simulation-based learning, and emerging AI-enabled immersive experiences—continues to expand across higher education, yet implementation remains uneven, difficult to scale, and challenging to govern responsibly [1, 2]. Our recent Three-Phase hybrid Delphi–Fuzzy Delphi Consensus study (2024–2025) [3] responded to this need by synthesising international expert judgement into an actionable ILM Integration Framework structured around eight domains (pedagogy; faculty readiness; infrastructure and access; engagement and learning outcomes; collaboration; ethics and sustainability; assessment; and emerging AI/XR trends), underpinned by a 5P institutional alignment model (Pedagogy, People, Processes, Platforms, Participation) [4]. The study achieved strong/stable consensus on foundational requirements for effective integration (e.g., pedagogy-led design, faculty development, accessibility, ethical governance), while also surfacing persistent areas of divergence—particularly around (i) the added value and accessibility implications of advanced headsets for collaboration, (ii) centralised versus distributed XR support models (XR hubs), (iii) AI-driven adaptivity, transparency, and bias, and (iv) whether traditional assessment is "insufficient" for XR contexts [2, 5]. These contested areas are precisely where institutions currently need decision support, implementation patterns, and evidence-informed guidance [6].

This proposed panel is designed as a structured "bridge" between consensus and implementation: it will both disseminate key findings from the Delphi–FDM study and serve as an explicit methodological continuation—functioning as a modified Delphi re-convening that generates the next round of validated statements, decision rules, and a collaborative research agenda for Phase IV of the study.

2 Aims and research questions

The panel has three integrated aims:

1. Translate consensus into implementable pathways by co-developing practical "implementation archetypes" and decision prompts that institutions can use to adopt ILM responsibly under real constraints (budget, policy, access, staffing, sustainability).
2. Advance the Delphi study into a new phase focused on unresolved items and emerging tensions (AI–XR convergence; governance of biometric/learning analytics data; assessment validity; hub/federated support models; multi-device access models).
3. Build research and practice coalition (researchers, learning designers, XR developers, ethics and accessibility specialists, institutional leaders, students) to support subsequent data collection, multi-site pilots, and framework iteration (ILM Integration Framework v2.0).

Guiding questions include:

- *Where does AI-driven adaptivity add demonstrable pedagogical value in ILM, and what minimum governance conditions (transparency, bias mitigation, consent, opt-out) are required for responsible use?*
- *Under which institutional contexts is a centralised XR hub advantageous, and when are distributed or federated models more sustainable and equitable?*
- *What assessment approaches are most valid and scalable for immersive learning (performance-based, competency-oriented, analytics-supported), and what "fairness" safeguards are needed (familiarisation, alternative pathways, accessibility)?*
- *How should institutions decide between headset-based and headset-free (multi-device) immersive approaches to maximise participation and accessibility while managing sustainability and total cost of ownership?*

3 Proposed Continuation of the Delphi Study: Phase IV "Consensus-to-Implementation" Extension

This panel formally initiates a follow-up research track that extends the prior 3-phase design into an implementation-oriented cycle

3.1 Phase IV-A (This Panel as a Structured Delphi Re Convening):

Elicit and refine *new* statements, implementation conditions, and decision rules targeting unresolved items from the prior study. Stress-test the ILM Integration Framework and 5P model across contrasting institutional contexts (e.g., research-intensive vs teaching-focused; commuter vs residential; high vs low resourcing; global north vs global south; discipline-specific constraints such as healthcare, engineering, arts). Identify measurable indicators and minimum viable "evidence packages" needed to justify investments (learning outcomes, equity metrics, staff workload, sustainability impacts, governance readiness).

3.2 Phase IV-B (Post-Panel Fuzzy Delphi Mini-Round):

Convert panel outputs into a refined Delphi–FDM instrument (short form) focused on unresolved items + decision thresholds. Run an anonymised Fuzzy Delphi survey with an expanded expert pool (including accessibility, ethics, IT/security, and student representatives). Quantify consensus and dispersion while preserving uncertainty, producing an "Implementation Conditions Matrix" aligned to the eight domains and 5Ps.

3.3 Phase IV-C (Validation and Piloting):

Conduct targeted validation interviews and/or focus groups with institutions adopting different implementation archetypes. Launch small multi-site pilots (case studies) to examine feasibility, inclusivity, governance, and assessment validity in practice. Produce ILM Integration Framework v2.0, accompanied by a practical playbook and research agenda.

4 Panel Design: Using the Session as a Delphi Continuation Instrument

To preserve Delphi strengths (structured judgement, controlled feedback, and mitigation of dominant voices), the panel will use a modified Delphi-in-the-room design:

- Anonymous micro-rating rounds: Participants rate 8–12 carefully selected "unresolved" or "next-phase" statements via an anonymous digital poll (Likert + confidence). Results are displayed as aggregated distributions to reveal convergence and dispersion without identifying individuals.
- Moderated expert dialogue: Panelists interpret the rating patterns, highlight boundary conditions, and surface assumptions behind disagreement (e.g., differences in institutional capacity, regulatory regimes, accessibility infrastructure).
- Breakout synthesis: Small groups co-produce (i) implementation archetypes, (ii) decision rules (if/then conditions), and (iii) candidate indicators/metrics mapped to the 5Ps.
- Re-rating and prioritisation: Participants re-rate a subset of statements after discussion (capturing movement, stabilisation, or persistent divergence) and rank the top priorities for Phase IV-B survey inclusion.

This design intentionally uses the panel not only as dissemination, but as a data-generating step that produces a validated set of next-round items and contextual qualifiers for the follow-up Delphi–FDM.

5 Session Structure

The session follows a structured format designed to both present the key findings of the Delphi–FDM study and engage participants in refining and extending the ILM Integration Framework through collaborative discussion and rating activities.

- Opening: Presentation of the key Delphi–FDM findings, including the ILM Integration Framework and the 5P alignment model, together with a summary of unresolved items that require further investigation.
- Anonymous micro-Delphi round: Participants anonymously rate a set of unresolved or next-phase statements (e.g., AI-driven adaptivity, XR hub models, headset value and accessibility, and assessment sufficiency) using a real-time digital polling tool.
- Panel discussion: Panelists interpret the resulting rating patterns, discuss areas of convergence and divergence, identify boundary conditions, and relate disagreements to differing institutional contexts.
- Breakout discussions: Small groups collaboratively develop implementation archetypes, decision rules, and minimum evaluation metrics, each mapped to the five institutional alignment pillars (5Ps).
- Re-rating and prioritisation: Participants re-rate selected statements following discussion and prioritise key items for inclusion in the Phase IV-B Delphi–FDM instrument.
- Closing: Synthesis of the session outcomes, invitation to participate in the follow-up Delphi round and multi-site pilots, and outline of the planned open outputs and research continuation.

6 Panellists

The panellists—are leading experts in educational technology, immersive learning, and interdisciplinary collaboration— offering unique insights drawn from their work in higher education and beyond:

- **Daphne Economou** (Panel Co-Coordinator): Senior Researcher in immersive learning technologies, with extensive experience coordinating multidisciplinary projects. She coordinated the panel session, provided an overview of the 2024 iLRN panel and demonstrated the follow-up initiatives, including the Delphi-based framework and webinar outcomes [3] (onsite).
- **Daniel Mitelpunkt**: Director of the Digital Media Lab, Imperial College London. As an expert in institutional XR strategy and innovative media applications, he discussed drivers and blockers of XR adoption, sharing insights from Imperial College's strategic approach [7](onsite).
- **Paula MacDowell**: Assistant Professor specializing in educational technology, immersive learning, and AI literacy for educators. She explored authentic and inclusive design principles and the role of XR in teacher education [8](onsite).
- **Helen McKenna**: Head of the Interdisciplinary EdTech Lab at Imperial College London, focusing on inclusive design and collaborative XR projects. She highlighted innovative projects and ethical considerations for inclusivity in XR technologies [7](online).

- **Ioannis Doumanis**: Senior Lecturer and MSc Computing Course Leader, University of Central Lancashire, with expertise in integrating XR into computing curricula. He examined emerging trends, technical hurdles, and solutions for XR integration [9] (online).
- **Stavros Nikou**: Senior Lecturer in Digital Education, University of Strathclyde, specializing in the pedagogical integration of XR and AR competences. He discussed barriers to adoption and best practices for integrating ILM, referencing the Teachers' AR Competencies (TARC) framework [10](online).

7 Expected Outcomes and Contribution

This panel will generate concrete, community-authored outputs that directly extend the Delphi study:

- A curated "Phase IV-B" statement set (unresolved + emergent items) with contextual qualifiers and measurement suggestions.
- Implementation archetypes (e.g., central hub, distributed, federated hybrid; headset-first vs simulation-first/multi-device) linked to the eight domains and 5Ps.
- A draft Decision Support Toolkit outline (questions, thresholds, evidence prompts) enabling institutions to act on consensus while transparently managing uncertainty.
- A prioritised research agenda for AI–XR adaptivity, governance of biometric/analytics data, sustainable procurement, and assessment validity in immersive contexts.
- A recruitment pathway for the next Fuzzy Delphi mini-round and multi-site case studies, broadening representation and strengthening external validity.

By positioning the panel as a structured methodological continuation—rather than a standalone dissemination event—this session accelerates the transition from expert consensus to implementable, ethically governed, and scalable ILM practice in higher education.

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