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Design Thinking-Driven Policy Imperatives for the Curricular Integration of PISA 2029's MAIL Competency in Filipino In-Service Teacher Training

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Abstract

In the Philippine educational context, In-Service Teacher Training (INSET) remains central to teacher professional development and to sustaining educational reforms. As technological innovations—particularly artificial intelligence (AI)—reshape teaching and learning, teachers face increasing pressure to integrate AI and media tools in ways that are meaningful, ethical, and pedagogically sound. However, many existing INSET programmes continue to prioritise tool-based demonstrations rather than structured and reflective pedagogical practice, while challenges such as the digital divide, limited infrastructure, and unequal access to technology constrain responsible implementation. This descriptive-exploratory study examines how integrating Design Thinking (DT) and Media and Artificial Intelligence Literacy (MAIL)

within INSET can strengthen teachers' capacity to respond to these challenges while aligning professional development with international benchmarks such as the Programme for International Student Assessment (PISA) 2029 framework. The paper develops a conceptual framework illustrating how DT-informed INSET can operationalise MAIL competencies through practices such as ethical reflection, bias evaluation, iterative prototyping, peer feedback, and stakeholder validation. The analysis also considers feasibility factors including institutional readiness, technological resources, and sustainability requirements. By strengthening teachers' capacity to integrate ethical AI use, media evaluation, and human-centred problem solving into classroom practice, the proposed DT–MAIL–informed INSET approach functions as a skills multiplier that supports learners' development of critical thinking, ethical reasoning, digital literacy, adaptability, and other future-ready competencies.

Keywords: In-Service Teacher Training, PISA 2029, AI literacy, media literacy, design thinking

1. Introduction

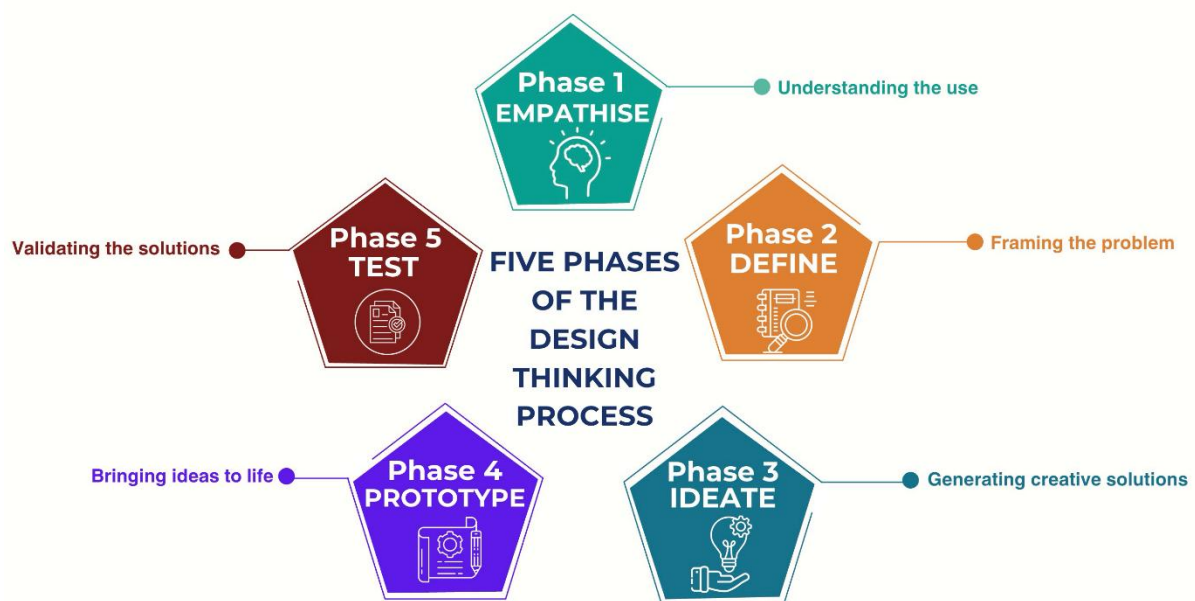
The educational sector continues to shift from traditional, prescriptive models of in-service teacher capacity-building toward more adaptive, dynamic, and competency-oriented professional learning ecosystems (Rivera et al., 2025). Among emerging paradigms, Design Thinking (DT) has gained prominence as a human-centred and context-responsive approach that positions teachers as reflective innovators capable of empathising with learners' needs, iterating pedagogical solutions, and fostering creativity within instructional practice (Baran & AlZoubi, 2023). However, the accelerating technological demands of the 21st century require teachers not only to cultivate these human-centred dispositions but also to develop the competencies necessary to navigate profound digital transformations reshaping education.

The growing discourse on the suite of literacies educators must possess has prompted the Programme for International Student Assessment (PISA) to introduce Media and Artificial Intelligence Literacy (MAIL) as a new assessment domain for its 2029 cycle, underscoring the urgency of preparing learners for an AI-mediated world. Recent studies highlight that teacher AI literacy is critical for effective MAIL integration, showing that structured professional development improves teachers' conceptual understanding, pedagogical application, and readiness to implement AI-mediated learning experiences (Deshen et al., 2026; Kim et. al, 2025; Zhao & Huang, 2025). While this direction is future-oriented, it presupposes that educators themselves possess the conceptual depth, operational understanding, and pedagogical readiness needed to enact these competencies meaningfully in classroom contexts. As INSET remains the primary mechanism for sustained professional development, this paper argues that INSET curricula must intentionally integrate DT and MAIL. Embedding this intersection within INSET design provides a policy-relevant pathway for cultivating digitally fluent, pedagogically agile, and future-ready Filipino educators capable of leading transformative learning in an AI-driven era. While this paper focuses on in-service teacher training as a policy entry point, its primary contribution lies in strengthening skills development outcomes for young people and early-career learners. Teachers are framed as skill multipliers whose pedagogical practices directly shape students' readiness for ethical digital participation, employability, and lifelong learning in an AI-mediated society. Reframing INSET through a Design Thinking and Media and Artificial Intelligence Literacy lens therefore links professional development reform to concrete learner skill outcomes rather than institutional change alone.

2. Design Thinking as a Springboard for Policy Advancements

Design Thinking (DT) is commonly defined as an iterative, creative, and user-responsive approach to problem-solving that emphasises understanding authentic needs, generating ideas, and refining solutions through continuous testing (Brown, 2008). This approach provides a structured yet flexible framework that supports innovation in complex and rapidly evolving educational environments. The five phases of the DT process—Empathise, Define, Ideate, Prototype, and Test—illustrate this cyclical and reflective methodology (see Figure 1).

FIGURE 1. THE FIVE PHASES OF THE DESIGN THINKING PROCESS



Source: original work of the authors, based on Brown (2008)

Expanding on this view, Obmerga (2020) characterises DT as a creative, human-centred method that cultivates key dispositions such as grit, empathy, and innovation among educational practitioners. Its relevance in education continues to grow due to its alignment with 21st century skills and global competencies, including metacognition, adaptability, innovation, and lifelong learning, positioning DT as a solid foundation for curriculum enhancement and policy reform.

Taken together, these perspectives underscore DT as both a mindset and a process essential to educational innovation, particularly in preparing teachers for emerging domains such as media and AI literacy under PISA 2029. As shown in Table 1, each phase of the DT model plays a distinct role in instructional and curricular design. When enacted through classroom practice, Design Thinking also functions as a mechanism for cultivating transferable learner skills, including creativity, collaboration, communication, and problem-solving. By embedding DT within INSET, teachers are better equipped to design learning experiences that mirror real-world innovation processes, thereby strengthening students' preparedness for early-career trajectories and future workplace demands.

TABLE 1. PHASES OF THE DESIGN THINKING MODEL IN INSTRUCTIONAL AND CURRICULAR DESIGN

Phases of DT	Instructional and Curricular Design
Empathise	The first stage focuses on understanding learners’ needs, contexts, and challenges. Empathy ensures that solutions are grounded in authentic realities rather than abstract assumptions. Research shows that empathy-driven inquiry enhances inclusivity and contextual relevance in higher education.
Define	Insights gathered from empathy are synthesised into clear problem statements. Effective problem framing through “How might we...?” questions ensure that solutions are actionable and aligned with educational challenges.
Ideate	Teachers and policymakers brainstorm multiple creative possibilities without prematurely judging ideas. Ideation fosters divergent thinking, which has been shown to strengthen collaboration and creativity in virtual classrooms.
Prototype	Ideas are transformed into tangible models or lesson designs that can be assessed in practice. A qualitative study of science teachers as resource writers found that prototyping enhanced creativity and iterative improvement in instructional materials.
Test	Prototypes are evaluated with real users to gather feedback. Testing is iterative, focusing on refinement rather than validation. Evidence from curricular design shows that design-thinking-based lessons significantly improve student engagement and competency development.

Source: own compilation of the authors based on the works of Alima et al. (2024), Alvarado (2025), Capili & Saludez (2024), Fitriyah et al. (2025), and Ramos & Inocian (2022)

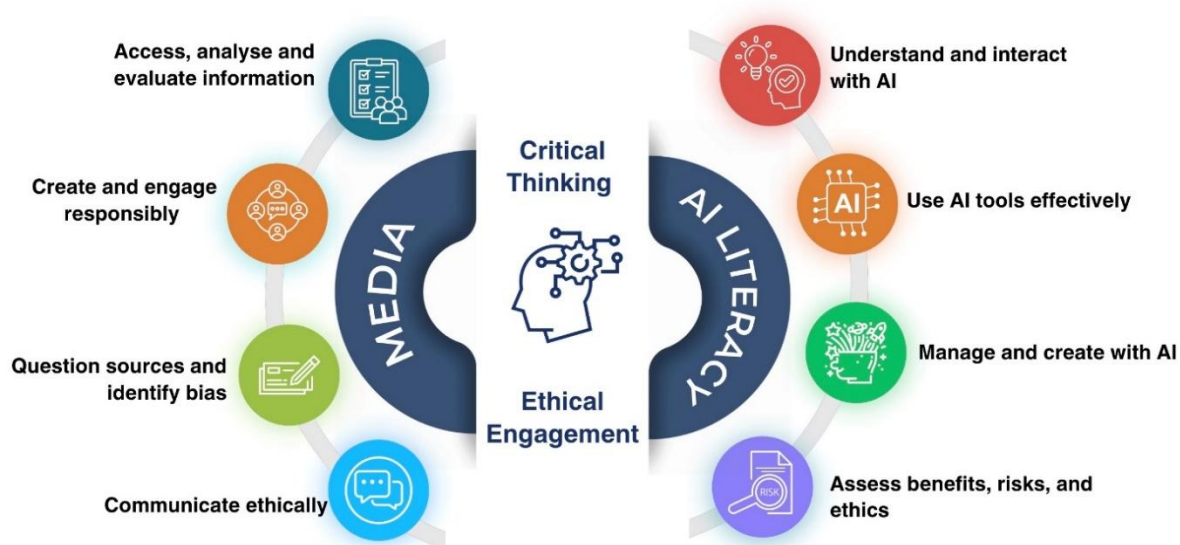
3. PISA 2029’s New Assessment Domain, Media and AI Literacy (MAIL)

Rapid technological advancement has positioned AI as an integral component of contemporary education. Integrating AI into learning competencies is essential to preparing students for participation in an AI-driven society. In response, the Organisation for Economic Co-operation and Development (OECD) introduced Media and Artificial Intelligence Literacy (MAIL) as a new assessment domain in PISA 2029 (see Figure 2). This domain emphasises learners’ capacity to think critically, act ethically, and engage responsibly with media and AI technologies (Wong, 2025).

Effective implementation of MAIL requires that teachers themselves possess the necessary knowledge, skills, and pedagogical strategies to integrate these competencies into classroom practice. As part of DT-driven policy imperatives, targeted INSET initiatives are essential to build teacher capacity for MAIL integration. While the OECD establishes the global framework for PISA 2029, the Southeast Asian Ministers of Education Organisation (SEAMEO) supports regional implementation by assisting member countries in contextualising teacher training and curriculum alignment in this emerging domain (Wong, 2025).

FIGURE 2. BEYOND READING AND MATH: PISA 2029 ADDS MEDIA AND AI LITERACY

Media + AI Literacy = MAIL



Source: original work of the authors, based on Wong (2025)

Table 2 aligns the MAIL competency framework with corresponding INSET priorities to ensure that teacher professional development directly supports classroom readiness for PISA 2029.

TABLE 2. MAIL COMPETENCY FRAMEWORK ALIGNED WITH IN-SERVICE TEACHER TRAINING NEEDS

MAIL Competency Area (PISA 2029)	OECD/SEAMEO Description	In-Service Teacher Training Implications
Understanding how digital & AI tools work	Learners understand how digital and AI tools function, including their capabilities, limitations, and mechanisms.	Training on AI fundamentals (algorithms, machine learning, generative AI)
Understanding the human role in digital tools & media	Learners recognise how people design, shape, and are affected by digital systems, platforms, and media.	Ability to explain AI-driven features in educational platforms
Social & ethical consequences of digital/AI use	Learners reflect on ethical concerns, including bias, privacy, surveillance, manipulation, and societal impact.	Skills to identify potential misuse and risks of AI within the classroom
Communicate & collaborate effectively using digital/AI tools	Learners engage productively, responsibly, and collaboratively using digital and AI-mediated platforms.	Knowledge of human-centred factors behind algorithms, data flows, platform design, and content moderation
Critically evaluate media content	Learners analyse AI-generated and human-generated media for credibility, intent, bias, and reliability.	Ability to teach students about data sovereignty, platform influence, and user agency

Source: own compilation of the authors based on the works of Alima et al. (2024), Alvarado (2025), Capili & Saludez (2024), Fitriyah et al. (2025), and Ramos & Inocian (2022)

Although MAIL is operationalised through teacher professional development, its intended impact is realised at the learner level. Teachers trained in MAIL translate ethical AI use, media credibility evaluation, and responsible digital engagement into classroom practices that directly shape students' future skills, including digital judgment, critical media analysis, and AI-aware decision-making essential for early-career participation in technology-rich environments

4. Evidence Base and Policy Context

This section synthesises key research on Philippine INSET, highlighting current practices, demonstrated impacts, and persistent gaps in integrating Design Thinking and Media and Artificial Intelligence Literacy. The evidence provides a foundation for identifying priority areas and informing targeted, practice-oriented INSET reforms.

4.1. The Nature and Dynamics of In-Service Teacher Training (INSET)

INSET and teacher professional development are consistently linked to teaching quality and student outcomes; however, their impact is constrained by access gaps, funding inconsistencies, and limited alignment with evolving pedagogies. Philippine studies highlight inequitable participation in INSET due to logistical and structural barriers (Rivera et al., 2025). At the classroom level, initiatives embedding DT demonstrate measurable gains in 21st-century competencies when teachers operationalise empathise–define–ideate–prototype–test cycles in instruction (Ramos & Inocian, 2022).

Science teachers engaged as learning resource writers further report that DT fosters user-centredness, iterative improvement, and creativity, though sustained practice requires clearer pedagogical framing and targeted capacity building (Capili & Saludez, 2024). Collectively, these findings suggest that Philippine INSET must shift from brief, centralised, and decontextualised offerings toward continuous, school-embedded, and DT-aligned professional learning pathways that explicitly cultivate MAIL competencies.

These findings indicate that strengthening INSET through DT-aligned approaches not only enhances teacher capacity but also generates downstream gains in students' 21st-century skills, reinforcing professional development as a lever for youth skills formations.

4.2. The Conduct of Filipino INSET at a Glance

Philippine INSET remains characterised by short duration, centralised delivery, and weak integration with classroom practice, limiting transfer and instructional relevance (Rivera et al., 2025). Despite needs assessments and available learning opportunities, outcomes are often constrained by unequal access to digital infrastructure and misalignment with contemporary competency demands. As a result, teacher learning frequently remains at the level of awareness rather than sustained pedagogical transformation.

Nonetheless, local studies demonstrate that DT-aligned pedagogies are both feasible and impactful in public school contexts. Virtual DT interventions in social studies improved critical thinking, communication, collaboration, and creativity (Ramos & Inocian, 2022); DT-guided science resource writing enhanced user-centred instructional design (Capili & Saludez, 2024); and DT-based science lessons produced significant gains in learning outcomes and prototype quality (Alima et al., 2024). These findings offer practical models for INSET reform grounded in localised DT application.

4.3. Challenges and Gaps in the Philippine INSET

Despite progress, persistent gaps remain in integrating Media and Artificial Intelligence Literacy within Philippine INSET. Studies indicate that teachers are underprepared to address critical thinking, misinformation, and ethical challenges due to limited pedagogical preparation in media and information literacy (Carambas & Tibaldo, 2025). Systemic barriers—including unequal access to technology, discontinuity of institutional support, and insufficient mechanisms for classroom application—further constrain effective implementation (Rivera et al., 2025).

These challenges are compounded by evidence that media and information literacy instruction in senior high schools often lacks depth, coherence, and sustained support (Bautista, 2021). Together, these findings underscore the need for INSET policies that are coherent, accessible, and firmly grounded in classroom practice to meaningfully strengthen teachers’ Media and Artificial Intelligence Literacy capacities.

5. Key Policy Gaps

Department of Education (DepEd) INSET memos (2020–2026) consistently lack MAIL and DT in both national and Schools Division Office (SDO)-level programmes. Training priorities centre on literacy, numeracy, leadership, and digital tools, but sessions on platforms like Open Educational Resources (OER), Canva, and M365 remain tool-focused, offering demonstrations rather than deeper engagement with AI reasoning, media analysis, misinformation, digital ethics, or structured innovation processes. Monitoring and evaluation exclude MAIL and DT indicators, and professional development resources provide no future-ready packages. This systemic gap leaves teachers unprepared for global benchmarks such as PISA 2029, which requires competencies in AI reasoning, media evaluation, creative problem-solving, and design thinking.

Table 3 shows INSET topics from SY 2020–2026 and their alignment with PISA 2029 skills. Across these years, structured MAIL and DT modules are absent. While some programmes introduced digital tools and creative strategies, these were scattered and lacked formal integration, limiting their impact on PISA readiness. Findings underscore the urgent need to embed AI literacy, media literacy, and design thinking into INSET at both national and SDO levels.

TABLE 3. DEPED INSET POLICY REFERENCES: MAIL/DT INTEGRATION (2020–2026)

School Year / Policy Reference	Key Topics / Target Participants / Design Thinking & MAIL Content
2020–2021 (DepEd Memo 081 s. 2020)	<p><i>Key Topics:</i> Curriculum challenges; learning delivery modalities; classroom assessment; learning resources; DepEd TV / satellite / multimodal platforms</p> <p><i>Target Participants:</i> Teachers (all levels)</p> <p><i>Design Thinking & MAIL content:</i> No design thinking or structured innovation; No explicit media or AI literacy training</p>
2021–2022 (OUA Memo 00-0821-0073)	<p><i>Key Topics:</i> OER; email etiquette; copyright; Canva for performance tasks; virtual delivery; radio/TV-based instruction; creative strategies; device awareness; Minecraft Education; video/app development; cyberbullying; Internet safety; Google PD</p>

	<p><i>Target Participants:</i> Teachers, IT Coordinators, School Admin</p> <p><i>Design Thinking & MAIL Content:</i> Creative tools used, but there was no structured design thinking process; Digital literacy topics appear, but no deep AI literacy</p>
2023–2024 (DM-OUHROD-2024-0037)	<p><i>Key Topics:</i> Higher Order Thinking Skills Professional Learning Packages (HOTS-PLP) (Eng/Math/Sci); Instructional Leadership; Microsoft 365; National Reading & Math Programmes; Learning Camp; English Language, Literacy, and Numeracy (ELLN); Curriculum, Supervision, and Evaluation (CSE) guidelines; Child Rights & Protection; Safe Spaces Act</p> <p><i>Target Participants:</i> Teachers, School Heads, Supervisors</p> <p><i>Design Thinking & MAIL content:</i> HOTS is present but not design thinking; No media/AI literacy component</p>
2024–2025 (DM-OUHROD-2024-2306)	<p><i>Key Topics:</i> Same focus areas as 2023–2024 INSET (HOTS-PLP, Instructional Leadership Training (ILT), Microsoft 365, literacy/numeracy programmes, policy guidelines)</p> <p><i>Target Participants:</i> Teachers, School Leaders</p> <p><i>Design Thinking & MAIL content:</i> No design thinking elements noted; No explicit MAIL or AI literacy</p>
2025–2026 (DM-OULS-2025-095 – Guidelines)	<p><i>Key Topics:</i> Reflective practice (Revised K–12); ARAL–Reading; inclusive instruction; literacy/numeracy strategies; critical & creative thinking; Social and Emotional Learning (SEL); flexible modalities; digital adoption; Alternative Learning System (ALS) instruction; enhanced guidance services</p> <p><i>Target Participants:</i> Teachers; Guidance Staff</p> <p><i>Design Thinking & MAIL content:</i> Critical/creative thinking present, but no explicit design thinking model; Digital adoption mentioned, but AI literacy undefined</p>

Source: own compilation of the authors based on Department of Education, 2020; Department of Education Schools Division Office Dasmariñas City, 2021; Office of the Undersecretary for Human Resource and Organizational Development, 2023, 2024; Office of the Undersecretary for Learning Support, 2025

INSET priorities have gradually improved but still show persistent gaps. Early cycles focused on delivery logistics, offering limited relevance to future-ready skills. Later years introduced digital tools and higher-order thinking (HOTS) for critical thinking, yet approaches remained tool-centric without structured DT or AI readiness training. The latest cycle added creative thinking and digital adaptation but lacked operational clarity and systematic innovation. Overall, while themes increasingly reflect PISA 2029 competencies, MAIL and DT remain missing, leaving teachers underprepared for next generation learning demands.

6. Policy Recommendations

The proposed policy recommendations are anchored on the intersection of DT and MAIL—a framework that combines human-centred innovation with future-ready digital competencies.

By aligning the five DT phases (Empathise, Define, Ideate, Prototype, and Test) with MAIL skills, INSET can move beyond tool-based demonstrations toward practical, ethical, and context-sensitive teacher development. This DT × MAIL approach, embedded in the curricular design of the INSET, ensures that training addresses real classroom challenges, promotes responsible AI and media use, and equips teachers to meet global benchmarks like PISA 2029 while remaining grounded in Philippine educational realities.

Collectively, these recommendations are designed to ensure that improvements in teacher capacity translate into measurable skills development outcomes for learners, particularly in relation to ethical AI use, critical media engagement, and employability-relevant competencies aligned with PISA 2029.

9.1. Empathise (Design Thinking) to Understand and Interact with AI (Media and Information Literacy)

- Include INSET activities like classroom reality mapping (teacher interviews, learner observation) to understand how AI tools are used in public schools.
- Integrate school-based focus group discussions during INSET to capture teachers' experiences with AI platforms (e.g., Learning Management System, DepEd Commons).
- Promote the development of regional AI use profiles based on empathy exercises to guide future localised training plans.

9.2. Empathise (Design Thinking) to Assess the Benefits, Risks, and Ethics of AI (Media and Information Literacy)

- Include the process of conducting Ethics Reflection Sessions during INSET, allowing teachers to identify potential risks such as bias, privacy breaches, and plagiarism, and to design appropriate classroom safeguards.
- Include the requirement for teachers to maintain ethics reflection journals during INSET to document emerging ethical concerns, contextual challenges, and insights related to AI-supported instruction.
- Include the implementation of risk-awareness workshops prior to the introduction of AI tools in lesson planning, ensuring that teachers critically examine possible harms and develop preventive strategies before integrating AI into classroom activities.

9.3. Define (Design Thinking) to Question Sources and Identify Biases (Media and Information Literacy)

- Include INSET modules on spotting misinformation and bias in media and AI-generated content.
- Include the requirement for teachers to apply bias-check rubrics during lesson plan preparation in INSET, ensuring that instructional decisions and AI-supported materials are evaluated for fairness and inclusivity.
- Include the provision of hands-on activities for detecting algorithmic bias in AI-generated outputs during INSET, enabling teachers to practice identifying unfair patterns and develop strategies to address them in classroom contexts.

9.4. Define (Design Thinking) to Assess the Benefits, Risks, and Ethics of AI (Media and Information Literacy)

- Require teachers to develop a risk register for any planned AI integration in classroom activities to ensure systematic identification of potential harms, vulnerabilities, and mitigation strategies.
- Require the alignment of problem statements with the PISA 2029 MAIL strands and ensure their documentation as part of INSET outputs to strengthen curricular coherence and competency-based planning.
- Include the use of ethics-based framing questions in INSET workshops to guide problem definition (e.g., “Whose rights, safety, or well-being might be affected when this AI or MAIL tool is used in the classroom?”) to ensure that problem framing remains learner-centred, ethical, and context-responsive.

9.5. Ideate (Design Thinking) to Create and Engage Responsibly (Media and Information Literacy)

- Include facilitated brainstorming sessions in INSET on responsible media use and engagement strategies under the theme “Foundation of Responsible Media Use: Balancing Screen Time and Learning Time” to equip teachers with practical, context-sensitive approaches.
- Require teachers to propose low-tech alternatives—such as offline digital self-learning modules, media bias-mapping activities, and curated educational video presentations—for classrooms with limited or unstable connectivity to ensure inclusive and equitable implementation of MAIL competencies.
- Institutionalise an Ethical Vetting and Expert-Bias Mapping process prior to prototyping to ensure that all proposed instructional solutions undergo systematic ethical review, address contextual realities, and remain free from stakeholder bias within the Philippine K–12 system.

9.6. Ideate (Design Thinking) to Use AI Tools Effectively (Media and Information Literacy)

- Provide training for teachers on free or low-cost AI resources—such as LearningFlowing.ai Library, Canva, MagicSchoolAI, Gradescope, and other teacher-friendly tools with free subscriptions—within INSET workshops to strengthen their capacity for lesson enhancement and creative instructional planning.
- Require the development of AI-supported instructional activities that uphold principles of inclusivity and transparency, ensuring that teachers intentionally design learning experiences aligned with ethical and equitable AI integration.

9.7. Prototype (Design Thinking) to Communicate Ethically (Media and Information Literacy)

- Integrate INSET sessions focused on developing accessible and bias-free prototypes, ensuring that teachers systematically apply ethical and inclusive design principles during instructional material development.
- Embed structured peer feedback loops to ensure validation of ethical communication within prototypes, enabling teachers to refine outputs through collaborative review and constructive critique.

9.8. Prototype (Design Thinking) to Manage and Create with AI (Media and Information Literacy)

- Establish safe AI practice spaces during INSET using familiar platforms such as DepEd Commons or Microsoft 365, enabling teachers to explore AI tools within secure and context-appropriate environments.
- Define clear standards for AI-assisted lesson outputs, ensuring that all teacher-created materials undergo careful review and demonstrate alignment with DepEd curriculum guides before classroom use.

9.9. Test (Design Thinking) to Analyse and Evaluate Information (Media and Information Literacy)

- Require teachers to use evaluation dashboards to assess media credibility and verify the validity of AI-generated outputs during INSET.
- Mandate iterative testing cycles—beginning with small-group pilots—prior to full-scale classroom implementation.
- Integrate structured exercises that train teachers to triangulate diverse media sources (e.g., academic databases, government agency reports, news websites, social media posts, videos, and blogs) and to critically validate AI-generated content for accuracy, reliability, and ethical compliance.

9.10. Test (Design Thinking) to Assess the Benefits, Risks, and Ethics of AI (Media and Information Literacy)

- Require stakeholder feedback loops (students, parents) during testing to assess ethical compliance.
- Enforce a structured risk reassessment after every test cycle, focusing on issues such as bias, data privacy, misinformation, accessibility, and learner safety, and require documentation of corresponding prototype improvements.
- Direct schools and divisions to conduct periodic audits of AI integration practices to ensure consistent ethical use, proper data handling, and alignment with policy expectations.

10. Feasibility Analysis

Ensuring the successful implementation of the proposed DT × MAIL policy recommendations require a thorough assessment of their feasibility. This section focuses on three critical areas: (a) operational and technological feasibility, (b) financial readiness of INSET providers, and (c) sustainability frontiers of the recommendations. Evaluating these aspects helps determine the practicality and long-term viability of integrating DT with MAIL into INSET across the Philippines.

10.1. Operational and Technological Feasibility

This dimension examines whether INSET providers and the DepEd have the capacity to deliver DT × MAIL-based training effectively. It considers the availability and accessibility of technological infrastructure, including computers, internet connectivity, learning management systems, and AI tools. It also assesses institutional readiness, such as the availability of trained facilitators, technical support staff, and established protocols for integrating AI and media literacy into workshops. Confirm that operational and technological requirements—such as functional devices, connectivity,

secure platforms, and trained facilitators—are in place so teachers can effectively engage in DT × MAIL training and implement its outputs in their instruction.

10.2. Financial Readiness of INSET Providers

Financial readiness evaluates whether INSET providers and the DepEd have the necessary resources to implement DT × MAIL–based training. This includes funding for workshop facilitation, procurement of AI and media tools, internet access, training materials, and compensation for facilitators. Assessing financial readiness ensures that the proposed reforms are economically viable within existing budget allocations and allows policymakers to identify areas requiring additional support to sustain high-quality teacher training.

10.3. Sustainability Frontiers of the Recommendations

Sustainability focuses on ensuring that the integration of DT and MAIL remains viable and impactful over the long term, in alignment with Sustainable Development Goal (SDG) 4’s vision of inclusive, equitable, and high-quality education. This requires sustained professional development for trainers, continuous updating and maintenance of AI and media literacy resources, and robust monitoring and evaluation mechanisms that support data-informed recalibration of training programmes. Institutional backing is also essential to enable iterative improvement and ensure that the DT × MAIL framework evolves with emerging educational needs. By strengthening these sustainability pillars, the approach not only supports immediate training objectives but also builds enduring teacher capacity and advances long-term improvements in classroom practice consistent with SDG 4 commitments.

11. Strategic Benefits of the DT-MAIL-INSET Convergence among Filipino and Non-Filipino Young Learners

INSET equips teachers with strategies, frameworks, and tools that directly translate into enhanced student learning. By integrating design thinking (DT) with media and information literacy (MAIL), professional development enables teachers to design classroom tasks that cultivate students’ critical thinking, creativity, digital literacy, ethical reasoning, and problem-solving (Blundell, 2024). In this way, INSET functions as a skills multiplier, transforming teacher learning into tangible, future-ready competencies for students in AI-rich learning environments. These competencies are most effectively developed when classroom activities are structured around the iterative phases of design thinking.

During the Empathise phase, learners map their own AI use through classroom discussions or digital journals, reflect on ethical dilemmas, and document their experiences, fostering reflection, analysis, and ethical reasoning. In the Define phase, they examine media and AI-generated outputs to identify bias, compare responses with credible sources, and record their findings, strengthening critical questioning, data literacy, and informed decision-making. During Ideate, learners brainstorm solutions for responsible AI engagement, design collaborative projects, and explore both low- and high-tech tools, developing creativity, collaboration, and ethical problem-solving. In the Prototype phase, they produce AI-assisted outputs such as portfolios, reports, or presentations and refine them through peer and teacher feedback, enhancing tool management, communication, and iterative design skills. Finally, in the Test phase, learners verify the accuracy of AI-generated content, revise their work based on feedback, and reflect on their learning process, building advanced critical thinking, information

literacy, adaptability, and ethical judgment. Taken together, these classroom practices illustrate how the DT process operationalizes the skills targeted by MAIL-informed instruction (Tiernan et al., 2025; Tsang, 2025).

By linking INSET with DT and MAIL, teachers transform professional learning into meaningful student experiences. Each DT phase provides structured opportunities for students to practice and internalise skills essential for navigating digital environments, making informed decisions, and engaging ethically with AI technologies. The downstream benefits are significant: students become adaptive problem-solvers, digitally literate decision-makers, and ethically aware participants equipped with competencies essential for academic, professional, and societal contexts. This DT × MAIL-informed INSET approach ensures that teacher development focuses not only on mastering tools but also on designing learning experiences that prepare students for an evolving AI-driven world (Long & Magerko, 2020). Evidence from different educational contexts further demonstrates how these benefits manifest in practice.

While these benefits are generalisable, their impact varies by context. Among Filipino learners, DT-integrated e-learning in senior high mathematics has increased engagement and resourceful problem-solving (Erenea & Sarmiento, 2025). In Vietnam, DT-based STEM lessons improved students' critical thinking and application of STEM knowledge, with strong model fit indices supporting the instructional design (Nguyễn et al., 2025). In European research, school-based design thinking-making approaches documented gains in elementary students' cognitive skills, self-efficacy, and collaboration (Herodotou et al., 2025; Li et al., 2024). Overall, these studies show that Design Thinking strengthens students' engagement and higher-order skills across diverse educational contexts. However, implementing such approaches also raises practical considerations for educators and learners. Additional research demonstrates that combining design thinking with AI literacy in STEAM and interdisciplinary settings significantly enhances student creativity, critical thinking, and problem-solving, providing further empirical support for the DT × MAIL-informed INSET approach (King & Yan, 2025; Lin & Chang, 2025).

Several challenges may emerge for both teachers and learners in the coming years. Teachers may encounter time constraints, limited familiarity with emerging AI tools, and difficulty integrating DT frameworks with MAIL principles in culturally diverse classrooms. Learners may face uneven access to technology, disparities in digital literacy, and cognitive overload when navigating complex tasks. Addressing these challenges may require sustained INSET programs, scaffolded AI literacy instruction, and equitable access to digital resources.

12. Conclusion

Integrating Design Thinking and Media and Artificial Intelligence Literacy into In-Service Training is essential not only for teacher professional development but, more importantly, for advancing skills development among young people and early-career learners in alignment with PISA 2029. Existing INSET programmes show gaps in preparing teachers for ethical AI use, media credibility evaluation, and innovation-oriented problem solving, which limits effective classroom integration and exacerbates digital inequities. Embedding a DT × MAIL framework can strengthen teacher professional development by making it more human-centred, context-responsive, and practice-oriented. For policymakers and school leaders, these findings offer practical directions for redesigning INSET toward sustained capacity building rather than short-term tool exposure. By positioning teachers as skill multipliers, the DT × MAIL framework

strengthens the connection between professional development, classroom practice, and learners' future employability, adaptability, and ethical participation in an AI-driven society. This policy brief draws from current literature and practitioner perspectives; implementation outcomes may vary across contexts. Overall, DT × MAIL–aligned INSET reforms can enhance instructional quality, ethical digital practice, and system readiness for an AI-mediated future.

13. Empirical Research Directions Arising from the Present Descriptive-Explanatory Work

The present inquiry is descriptive–exploratory in nature and does not employ a formal empirical methodology. Rather, the paper develops a conceptual synthesis that integrates Design Thinking (DT), Media and Artificial Intelligence Literacy (MAIL), and In-Service Teacher Training (INSET) within the Philippine educational context. By examining how these elements may converge to strengthen teacher professional development and student learning, the study offers a conceptual framework that can guide future empirical investigations.

Several potential directions for empirical research emerge from the DT–MAIL–INSET convergence proposed in this work. Future studies may examine how participation in DT-informed INSET influences teachers' instructional practices, particularly how educators apply the iterative phases of design thinking to design learning tasks that incorporate media evaluation, ethical AI use, and responsible information practices. Empirical investigations may also explore how such classroom practices support students' acquisition of critical thinking, digital literacy, collaboration, ethical reasoning, and creative problem-solving skills when engaging with AI-generated content and media sources.

Further research may also consider contextual and implementation factors that influence the effectiveness of the proposed framework. Comparative studies may examine variations across school environments, levels of technological access, and institutional capacities, both within the Philippines and across other educational contexts. In addition, future inquiry may investigate the sustainability and scalability of DT–MAIL–informed INSET initiatives, including how professional learning structures can remain adaptive as AI technologies and digital learning environments continue to evolve. Together, these research directions provide pathways for empirically examining and refining the conceptual insights advanced in this study.

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Ethics Statement

For studies involving human participants, the authors confirm that the research complied with relevant institutional and national ethical standards. Ethical approval was obtained where required, and informed consent was secured from all participants prior to data collection. If ethical approval was not required, the authors confirm that the study adhered to applicable ethical guidelines.

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