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List of acronyms

Acronym	Description
AI	Artificial Intelligence
4Cs	Creativity, Critical thinking, Collaboration, Communication
ADDIE	Analysis, Design, Development, Implementation, Evaluation
augMENTOR	Augmented Intelligence for Pedagogically Sustained Training and Education
CHAT	Cultural and Historical Activity Theory
EC	European Commission
ET	Emerging Technologies
EU	European Union
ISD	Instructional Systems Design
PeDeMET	augMENTOR Pedagogical Design Model with Emerging Technologies
PF	Pedagogical Framework
PLC	Professional Learning Communities
TESA	Technology-augmented Educational Scenarios
TETPACK	Technological Emerging Technologies Pedagogical Content Knowledge
TPACK	Technological Pedagogical Content Knowledge

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Executive summary

This document, D7.5 - Policy Brief Interim, presents a comprehensive overview of the augMENTOR project's policy recommendations and implementation strategies for integrating Artificial Intelligence (AI) and Emerging Technologies (ET) into education. Key highlights include the introduction of the augMENTOR Pedagogical Framework (PF), which bridges technological and pedagogical dimensions to create a cohesive and dynamic learning environment. This framework integrates foundational models such as TPACK (Technological Pedagogical Content Knowledge) and Activity Theory while extending their applications with AI and ET. By emphasizing a holistic approach, the PF addresses the needs of educators, learners, and educational contexts, promoting personalized and adaptive learning pathways.

The policy briefs within this document focus on critical areas such as capacity building for educators, curriculum alignment with AI competencies, and fostering ethical AI use in education. Recommendations include specialized professional development programs, collaborative learning communities, and mentorship opportunities to equip educators with the skills and confidence to implement AI-enhanced tools effectively. The framework also supports the assessment and integration of transversal competencies—critical thinking, creativity, collaboration, and communication—through rubric-based evaluation methods.

Implementation strategies outlined in this document emphasize scalable training methods, stakeholder collaboration, infrastructure development, and continuous feedback loops. These approaches ensure that AI and ET can be responsibly and effectively embedded into diverse educational settings, fostering innovation, equity, and inclusivity.

The augMENTOR D7.5 Policy Brief Interim provides actionable insights for policymakers, educators, and stakeholders, contributing to the broader goal of sustainable and transformative educational practices.

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1 Introduction

1.1 Adaptive learning and personalised education pathways through augMENTOR

Through adaptive learning, augMENTOR seeks to empower both students and educators, using AI-driven technology to make informed decisions about the learning process, thereby using current emerging technologies to optimise personalised pedagogies. Pedagogy, defined as the methods and practice of teaching and learning, is changing in some contexts from instructor-centred to student-centred approaches through different innovative approaches such as personalised and adaptive learning methods (Taylor et al., 2021). Based on constructivist and social cognitive learning science approaches, the student-centred approach aims to engage learners in the classroom by encouraging them to take initiative, think critically, and creatively engage with the learning activities. Rather than passively receiving information, constructivist approaches aim to engage learners to participate actively in the learning process, allowing them to develop essential skills and engage in deeper learning activities that enhance cognitive growth. Personalised learning aims to support the learners by personalising the learning activities according to the learners' needs (Prain et al., 2013). Learning personalisation can be supported by adaptive learning platforms. These technologies aim to identify individual student needs based on a Learner Model (LM) and a task model, and provide scaffolding for learning. Scaffolding refers to the support and guidance provided to learners so they can accomplish a task or demonstrate competence independently.

Using the student's activity profile and the analysis of the learners' activity (*learning analytics*, LA), the augMENTOR solution can track progress and refine learning progression paths to meet the needs of each student. These tools also allow for personalised scaffolding and targeted interventions, enhancing each student's journey towards success.

1.2 Support of transversal competencies through AI

During the latter decades of the 20th century and into the 21st century, educational stakeholders recognized the growing need for transversal competencies to prepare students for the demands of the future (Geisinger et al, 2016). The augMENTOR project aims to contribute to the development of these competencies through the learning activities in the pilot courses and the transversal competencies assessment.

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The evolution of AI statements have permitted the development of augmented approaches to human activities through the use of specific AI tools (Razmerita et al., 2024), as well as the metacognitive potential in human-AI collaboration (Romero, 2024, Urmeneta & Romero, 2023). Some approaches have referred to human-AI collaboration as a hybrid intelligence (HI) as the ability to accomplish more complex objectives in the AI support of human activities. Considering the perceived difficulty of the assessment of transversal competencies, we aim to support the teachers and the learners through an AI based solution in which the 4Cs assessment is supported in order to allow the learners and teachers to better regulate their learning activities.

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2 Integrating Artificial Intelligence in pedagogical approaches

2.1 the augMENTOR Pedagogical Framework

In the framework of augMENTOR a lot of work has been done on blending emerging technologies with contemporary teaching and learning practices. Based on our work, we aim to deliver the augMENTOR Pedagogical Framework (PF). The first version of this framework was presented in deliverable D3.1 - The augMENTOR Pedagogical Framework Interim.

Based on the state-of-the-art review conducted as the initial task of the augMENTOR Pedagogical Framework (PF) proposal, it became evident that no existing pedagogical framework fully satisfies the project's requirements. Current models and approaches are applied only partially, prompting the need for a novel and untested methodology.

Specifically the reviewed studies primarily focus on specific pedagogical aspects, approaches, and strategies, without addressing the integration of AI into established pedagogical frameworks. While the importance of employing AI throughout the educational process is acknowledged, its incorporation into comprehensive pedagogical models remains unexplored. This gap aligns with the objectives of the augMENTOR project, which aims to integrate emerging technologies into education and training through a new pedagogical framework that balances technological and pedagogical dimensions. To address this, augMENTOR has developed a digitally enhanced pedagogical framework, grounded in creative pedagogy principles, extending established models like TPACK (Technological Pedagogical Content Knowledge framework is an educational model that describes the intersections between technology, pedagogy, and content for the effective integration of technology into teaching. TPACK became popular in the early 2000s) to incorporate artificial intelligence, bridging the identified gap in existing studies.

So the literature review led to the proposal of an innovative framework focusing on the interactions between learners and educators when using technological tools, particularly AI. Recognizing that existing frameworks are overly general and insufficient for designing classroom-level lessons, we developed a new approach based on Activity Theory, which distinguishes between macro-level theoretical concepts and micro-level classroom practices. This framework extends established models like ADDIE (ADDIE is an Instructional Systems Design (ISD) framework that many instructional designers and training developers use to develop courses. The name is an acronym for the five phases it defines for building training and performance support tools: Analysis, Design, Development, Implementation, Evaluation) and

introduces an "enriched pedagogical triangle" to integrate technological and pedagogical knowledge comprehensively.

The augMENTOR framework also proposes expanding TPACK into TETPACK, incorporating Emerging Technologies (ET), specifically AI, into teacher competencies. At the classroom level, it introduces a data-driven model, the Technology-augmented Educational Scenarios and e-Activities (TESA), to bridge theory and practice. This framework aligns with various project components, such as user requirements (D2.1), the Learner Model (T3.3), creative pedagogy integration (T4.2), 21st-century competencies assessment (T4.3), and data/resource orchestration (WP5), ensuring coherence and validation across the project's work packages.

The augMENTOR PF, is a novel pedagogical design framework tailored for the needs of the augMENTOR project. Drawing from the analysis of Emerging Technologies in education, as well as established Instructional and Learning Design models, it addresses the limitations of existing frameworks, which often focus singularly on the teacher, learner, or content. This singular focus can hinder the creation of cohesive teaching and learning processes.

The augMENTOR PF shifts the emphasis to the holistic activity of the classroom, incorporating learners, educators, content (knowledge), their interactions, and the tools employed, as framed by Activity Theory. This broader concept of Pedagogical Design integrates planning, structuring, and the use of technologies (particularly Emerging Technologies) to create meaningful, engaging, and outcome-focused learning experiences. Unlike conventional models, it equally considers educators, learners, technological tools, and context.

The PeDeMET model offers an innovative approach to designing teaching and learning processes. On a theoretical level, it integrates insights from modern learning sciences and educational technology into a cohesive framework aimed at creating effective and engaging educational experiences. Practically, its objective is to produce a structured educational product that outlines the components of a teaching intervention, providing clear guidance to educators and learners for achieving defined learning goals. This practical outcome aligns with the Technology-augmented Educational Scenarios and e-Activities (TESA) methodology and is referred to as the Educational Scenario with Digital Technologies (Komis, 2019).

The augMENTOR Pedagogical Framework, along with its two specialized models—PeDeMET at the macro level and TESA at the micro level—derives its conceptual foundation from three interconnected theoretical frameworks. These frameworks are synthesized into a unified system for describing, analyzing, and evaluating teaching and learning processes (Figure 1):

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1. **The enriched Pedagogical Triangle with Digital Technologies** (Komis, 2019)
2. **Technological Pedagogical Content Knowledge (TPACK)** (Mishra & Koehler, 2006) and
3. **The Cultural and Historical Activity Theory (CHAT)** (Kaptelinin & Nardi, 2006)

This integrated framework bridges theory and practice, providing a robust foundation for technology-enhanced education.

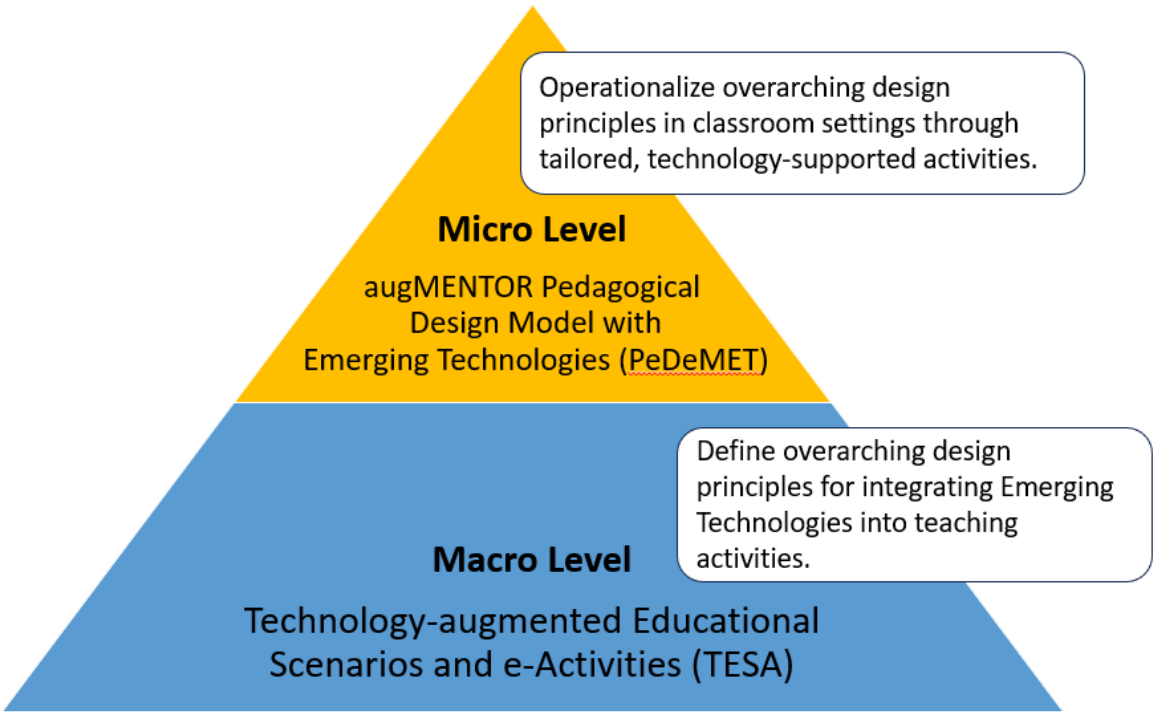

Figure 1. Pedagogical Framework Structure

This approach emphasizes the importance of digital tools in enriching pedagogical activities, facilitating seamless integration of Emerging Technologies into teaching and learning processes.

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2.2 Policy Recommendations and Implementation Strategies

In this section, we present a set of policy recommendations related to the use of the augMENTOR pedagogical framework. A brief summary is also included in the leaflet presented in the Annex.

Support the integration of Emerging Technologies (ET), and enhance educators' abilities to use AI in enriching learning experiences

Policy Brief: There is an evident need for a comprehensive professional development strategy to equip educators with the skills and confidence to integrate ETs in their current teaching practices. To achieve such an integration it is imperative that educators are properly trained and equipped to use AI in enriching learning experiences. Such training requires the introduction of an approach that combines theoretical insights with practical applications that can foster innovative teaching practices, support the integration of ETs, and enhance educators' abilities to use AI in enriching learning experiences.

The evolving regulatory landscape, exemplified by the EU AI Act, highlights the dual challenge of fostering innovation in education while safeguarding against risks such as bias, inequity, and misuse (Novelli et al., 2024). The Act emphasises the development of safe, trustworthy AI systems that respect fundamental rights and uphold principles of transparency and accountability, particularly through mandates such as labeling generative AI outputs to mitigate risks of manipulation and misinformation. This is where frameworks like augMENTOR become essential. By equipping educators with the skills and confidence to integrate AI responsibly into teaching, augMENTOR addresses the need for AI literacy and ethical implementation raised in the Act. Its focus on professional development, mentorship, and practical applications ensures that educators not only comply with emerging regulations but also harness AI's transformative potential to create more inclusive, personalised, and impactful learning experiences.

The augMENTOR Pedagogical Framework is fully aligned with the aforementioned need and can play the role of the framework needed to support educators in integrating ETs in their teaching successfully.

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Implementation Strategy**:** To effectively train educators in applying the **augMENTOR Pedagogical Framework**, a multifaceted professional development plan is necessary. This plan combines theory with practice, leveraging hands-on training and digital tools to ensure educators can integrate Emerging Technologies (ET) into teaching and to be able to to gain confidence in using AI and Emerging Technologies, develop practical strategies for digital integration and foster innovative and creative pedagogical practice. Key methods include:

1. **Workshops and Interactive Training**: Provide hands-on experience with the framework's components (e.g., PeDeMET, TESA) and Emerging Technologies.
2. **Online Learning Modules**: Self-paced content focused on Activity Theory, enriched Pedagogical Triangles, and practical tools for lesson design.
3. **Collaborative Learning**: Encourage peer coaching and Professional Learning Communities (PLCs) to share best practices.
4. **Modeling and Demonstrations**: Showcase example lessons integrating AI and other technologies.
5. **Mentorship Programs**: Pair educators with experienced mentors to refine their implementation strategies.
6. **Action Research**: Support educators in testing and reflecting on AI-enhanced pedagogical practices.
7. **Integrated Development Plans**: Align training with institutional priorities, offering continuous resources like templates and handbooks.
8. **Assessment and Feedback**: Use surveys and evaluations to refine teaching practices and training programs

Training Educators to Use the augMENTOR Pedagogical Framework

Below we elaborate more on the methods proposed, to train educators in effectively using the augMENTOR Pedagogical Framework, tailored to meet diverse learning needs and optimize technology integration:

1. **Workshops and hands-on training** are designed to help educators become familiar with the framework's concepts and tools. These sessions include interactive activities focused on exploring the Pedagogical Triangle and its extensions, such as TPACK and TETPACK. Participants will also engage in simulations of Technology-augmented Educational Scenarios

(TESA) and guided practice in using emerging technologies for lesson design. The expected outcome is that educators will gain confidence and technical skills necessary to implement the framework in their teaching.

2. **Online modules and self-paced learning** provide educators with flexible learning options. These modules will cover topics like Activity Theory and PeDeMET, and will include opportunities for earning micro-credentials or certifications. The content will incorporate quizzes, reflection journals, and peer interactions to deepen understanding. This approach ensures that educators can build foundational knowledge while accommodating their varied schedules.
3. **Collaborative learning and peer coaching** play a key role in fostering experience sharing and community building among educators. Professional Learning Communities (PLCs) will be established, where educators can engage in peer observations followed by feedback sessions. In addition, group problem-solving activities around the integration of AI in classroom settings will be facilitated. These activities are intended to promote reflective practice and shared learning among peers.
4. **Modeling and demonstration lessons** provide educators with practical applications of the framework. Experts will be invited to demonstrate AI-enhanced lessons, which will be recorded and shared with educators. Annotated examples of successful Educational Scenarios and e-Activities will also be provided. This will allow educators to observe the theory in action and adapt similar strategies to their own classrooms.
5. **Mentorship programs** aim to support less experienced educators by pairing them with mentors skilled in the framework. These programs will include regular one-on-one sessions, co-designing and reviewing lesson plans, and discussions about challenges faced in the classroom. The objective is to sustain continuous improvement while building educator confidence.
6. **Action research and reflective practice** encourage educators to experiment with and refine their approaches. Educators will design classroom-based research projects, use reflective journals to assess the impact of emerging technologies on learning, and present their findings in institutional meetings or forums. This approach deepens understanding of the framework in real-world educational settings.
7. **Integrated professional development plans** will embed augMENTOR training within institutional professional development programs. Training sessions will be aligned with school priorities, and follow-up sessions will be scheduled to revisit key concepts. Resources like handbooks, templates, and digital tools will also be provided to ensure ongoing engagement with the framework.

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8. **Custom tools and resources** will offer educators practical aids to support their teaching. Lesson plan templates that integrate PeDeMET components will be designed, along with AI-driven tools for lesson analysis and improvement. Instructional videos explaining the enriched Pedagogical Triangle will also be created. These resources will make the framework easier to implement and support creative pedagogy.
9. **Assessment and feedback cycles** will track progress and identify areas for improvement in training. Pre- and post-training surveys will be conducted, and peer or supervisor evaluations will be used to provide constructive feedback. These cycles will help refine future training sessions and ensure that educators are effectively applying the framework. During the pilot phase, actively integrate trainers' feedback to address their needs and improve the training content. This phase provides an opportunity to adjust and modify materials to ensure they are effective and aligned with the trainers' expectations.

Together, these methods will ensure that educators are well-equipped to apply the augMENTOR framework in diverse teaching contexts, using emerging technologies to enrich learning experiences.

Embedding AI in Educational Program Design - Guidelines for curriculum development on Embedding AI in the educational program design

Policy Brief: While training educators is a necessary step for integrating ETs and AI into pedagogies, it is not sufficient on its own. . Updating current curricula to embed AI in educational programs design is also essential. It is necessary to outline a framework for integrating AI into curriculum development, aiming to enhance educational outcomes by addressing cognitive, instructional, and technological needs. The guidelines proposed, that are based on the augMENTOR PF ensure that AI tools are effectively leveraged to develop essential competencies, foster creative pedagogies, and align with broader educational priorities.

Implementation Strategy**:** PeDeMET integrates the principles of three foundational theoretical frameworks: the enriched Pedagogical Triangle with Emerging Technologies, the TPACK model, and Cultural-Historical Activity Theory (CHAT). This model is designed to structure and manage pedagogical activities involving educators and learners across formal educational settings, such as classrooms, universities, hybrid, or distance learning environments. Unlike traditional approaches centred on educators, content, or technology,

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PeDeMET takes a holistic view, emphasising the entirety of activity rather than isolated components. To redesign curricula PeDeMET incorporates the following elements:

1. **Needs Analysis:** This step involves assessing the cognitive and instructional needs of both teachers and learners. It takes into account the diverse needs of participants, considering both teacher-centred and learner-centred perspectives. The needs analysis aligns with findings from D3.3 (section 3.2, "The Cognitive Domain") and D2.1 (section 5.4.3, "User Requirements").
2. **Content Delineation:** In this phase, the curriculum defines the specific educational content and knowledge that learners need to engage with. It adopts a knowledge-centred approach, ensuring that the content aligns with the thematic requirements outlined in D2.1 (section 5.4.3).
3. **Tool Integration:** This guideline emphasises the integration of both physical and symbolic tools, including AI and ICT. It assesses the pedagogical and technological value of these tools in supporting and mediating learning activities, ensuring they are appropriately utilised to enhance the learning experience.
4. **Outcome Identification:** The curriculum defines educational outcomes not only in terms of knowledge acquisition but also in terms of key competencies such as creativity, critical thinking, communication, and collaboration (the 4Cs). This step is aligned with D4.1 (section 3, "State-of-the-Art of the 4Cs").
5. **Learning Strategies:** This step outlines the methods and pedagogical approaches through which the 4Cs and other desired outcomes will be achieved. It incorporates insights from D4.1 (section 2, "Creative Pedagogies"), ensuring that teaching strategies foster an environment conducive to the development of these competencies.
6. **Assessment Methods:** This guideline specifies both formative and summative assessment procedures to evaluate learning outcomes and activities. It emphasizes the importance of proper feedback mechanisms and learner assessment practices to support continuous improvement and achievement of learning goals.
7. **Contextual Placement:** Teaching and learning activities are situated within broader school and social environments, acknowledging the reciprocal influences between educational practices and their context. This ensures that the curriculum remains relevant to the real-world settings in which it is applied.

By integrating these elements, PeDeMET bridges theoretical and practical dimensions of teaching, fostering a comprehensive and innovative approach to pedagogical design in the context of Emerging Technologies.

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Supporting AI-Enhanced Pedagogical Tools

Policy Brief: Enhancing teaching and learning through AI-enabled innovations entails a series of steps at policy level. Efforts need to be made to promote the integration of AI tools into education, addressing needs such as professional development, infrastructure, funding, curriculum alignment, and ethical considerations

Implementation strategy: To support AI-enhanced pedagogical tools, policymakers and stakeholders can rely on several key strategies:

1. **Capacity building for educators** is crucial. This can be achieved by developing and funding specialised professional development programs that focus on the integration of AI tools into pedagogical frameworks, such as augMENTOR. Additionally, providing educators with a fundamental understanding of AI technologies will help them feel confident and competent in using AI-enhanced tools effectively.
2. **Ensuring infrastructure and resources are in place** is also essential. Schools must have reliable access to the internet, devices, and software to facilitate AI integration. Collaboration with developers is also necessary to create user-friendly AI tools tailored to educational needs, aligning with pedagogical frameworks like augMENTOR.
3. Third, in terms of policy and funding, **incentivizing innovation** is important. Policymakers can offer grants and other incentives for institutions and educators to pilot AI-enhanced teaching methods. Long-term investments should also be made in sustainable AI integration, including funding for research, tool development, and teacher support.
4. **Ensuring infrastructure and resources are in place** is also essential. Schools must have reliable access to the internet, devices, and software to facilitate AI integration. Collaboration with developers is also necessary to create user-friendly AI tools tailored to educational needs, aligning with pedagogical frameworks like augMENTOR. In addition to infrastructure and resources, targeted policy and funding strategies are crucial for supporting the integration of AI tools in education. Policymakers can offer grants and other incentives for institutions and educators to pilot AI-enhanced teaching methods. Long-term investments should also be made in sustainable AI integration, including funding for research, tool development, and teacher support
5. **Curriculum integration** should be prioritised. Curricula should be aligned with AI competencies to introduce students to AI-related knowledge and skills, preparing them for future careers. AI can also be used to support creative pedagogies,

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promoting critical thinking, collaboration, and creativity in the classroom.

6. **Stakeholder collaboration** is vital. Public-private partnerships involving technology companies, universities, and policymakers can foster the development of tools and training initiatives. It is also important to involve parents and local communities in understanding and supporting AI's role in education.
7. **Ethical and inclusive use of AI in education** should be prioritised. AI tools must be designed to be inclusive, free of biases, and respect data privacy. Policymakers should establish frameworks to protect student data and ensure the ethical use of AI in the classroom.
8. **Monitoring and evaluation** play a critical role in the success of AI-enhanced pedagogy. Regular feedback from educators and students can help refine AI tools and teaching practices. Developing performance metrics will help assess the effectiveness of AI-enhanced pedagogical strategies.

The integration of artificial intelligence (AI) in education has the potential to transform teaching and learning processes by enhancing personalization, efficiency, and effectiveness. However, to fully realize these benefits, it is essential to establish comprehensive policies that ensure equity, accessibility, and ethical deployment of AI tools in educational settings.

Challenges

1. **Equity and Access**: Unequal access to AI-enhanced tools could widen educational disparities between regions and socioeconomic groups.
2. **Ethical Concerns**: AI usage raises questions about privacy, bias, and accountability, which must be addressed to maintain trust and fairness in education.
3. **Teacher Support**: Educators require adequate training and resources to effectively integrate AI into their pedagogical practices.
4. **Curriculum Alignment**: AI tools must be aligned with curriculum objectives to avoid potential conflicts and maximize impact.

Recommendations

1. **Promote Accessibility and Equity**:
    - Establish public funding programs to ensure underprivileged schools have access to AI tools.
    - Develop partnerships with private and nonprofit sectors to create affordable AI solutions.

2. **Ensure Ethical AI Deployment**:
    - Enforce clear guidelines on data privacy and ethical use of AI in schools.
    - Conduct regular audits to identify and mitigate biases in AI systems.
3. **Support Teacher Development**:
    - Invest in professional development programs to train educators on the effective use of AI-enhanced tools.
    - Encourage collaboration between teachers and AI developers to create tools that meet classroom needs.
4. **Policy and Regulatory Framework**:
    - Develop policies to monitor AI's impact on learning outcomes and equity.
    - Establish a regulatory body to oversee the implementation and evaluation of AI tools in education.
5. **Encourage Research and Innovation**:
    - Support research into the long-term effects of AI on learning and teaching.
    - Foster innovation by funding pilot programs and case studies to identify best practices.

Implementation Strategies

- **Public Awareness Campaigns**: Increase awareness of the benefits and limitations of AI in education to build stakeholder trust.
- **Collaborative Platforms**: Establish platforms for educators, policymakers, and AI developers to share insights and co-develop solutions.
- **Evaluation Metrics**: Develop robust metrics to evaluate the effectiveness and equity of AI-enhanced tools.

Supporting AI-Enhanced Pedagogical Tools within the augMENTOR Pedagogical Framework

Policy brief: The augMENTOR Pedagogical Framework provides a structured approach for integrating AI tools into education, focusing on enhancing teaching effectiveness, fostering student engagement, and developing key competencies such as creativity, critical thinking, communication, and collaboration. To support the framework's goals, targeted policies are required to ensure effective implementation, equitable access, and alignment with pedagogical objectives.

Challenges

1. **Educator Readiness**: Many educators are unfamiliar with AI-enhanced tools or how they integrate with augMENTOR components like PeDeMET and TESA.
2. **Infrastructure Gaps**: Limited access to reliable internet and devices in some schools hinders the adoption of AI tools.
3. **Ethical Concerns**: The use of AI raises issues related to data privacy, bias, and equitable treatment of diverse learners.
4. **Curriculum Alignment**: AI tools must align with the augMENTOR framework's focus on student-centered and competency-based learning.

Recommendations

1. **Capacity Building within augMENTOR**:
   - **Specialized Training**: Develop professional development programs tailored to the augMENTOR framework, focusing on integrating AI tools with models like PeDeMET (macro-level) and TESA (micro-level).
   - **AI Literacy**: Provide foundational AI training to educators to enhance their confidence and competence.
2. **Infrastructure Development**:
   - Equip schools with devices, software, and reliable internet to facilitate the use of AI tools aligned with augMENTOR.
   - Collaborate with AI developers to design tools that align with PeDeMET and TESA methodologies.
3. **Ethical AI Use within augMENTOR**:
   - Implement data privacy standards to safeguard student information when using AI tools.
   - Regularly evaluate AI tools to ensure they are free from biases and inclusive of diverse learners' needs.
4. **Curriculum Integration**:
   - Align AI tools with the competency-based goals of augMENTOR, such as developing the 4Cs (Creativity, Critical Thinking, Communication, Collaboration).
   - Use AI to support Technology-augmented Educational Scenarios (TESA), enabling personalized and adaptive learning experiences.
5. **Foster Collaboration and Innovation**:
   - Create partnerships between technology companies, educators, and policymakers to co-develop AI tools tailored to the augMENTOR framework.
   - Encourage pilot programs that use AI to enhance teaching strategies within the

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augMENTOR framework.

Implementation Strategy:

1. **Educator Development**:
    - Train educators to integrate AI tools into augMENTOR's PeDeMET and TESA components through workshops, self-paced modules, and mentorship programs.
    - Develop instructional resources like lesson templates, case studies, and instructional videos aligned with AI-enhanced tools.
2. **Infrastructure and Resources**:
    - Provide schools with the necessary infrastructure to implement AI-enhanced augMENTOR practices, including devices and software designed for educational use.
    - Ensure ongoing technical support and resource accessibility for educators and students.
3. **Ethical and Inclusive Deployment**:
    - Align AI tools with the enriched Pedagogical Triangle, ensuring ethical use, data privacy, and inclusivity for all learners.
    - Establish a monitoring system to evaluate the ethical implications of AI use in classrooms.
4. **Monitoring and Feedback Mechanisms**:
    - Develop feedback loops within the augMENTOR framework to assess the effectiveness of AI tools and pedagogical strategies.
    - Use performance metrics and teacher feedback to refine AI-enhanced practices.
5. **Stakeholder Engagement**:
    - Involve educators, administrators, parents, and students in discussions about AI integration within augMENTOR to ensure alignment with classroom needs.
    - Partner with universities and research institutions to evaluate the long-term impact of AI on teaching and learning.

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3 Introducing 21st century skills in the learning process

3.1 Future Readiness and the 4Cs

The workplace of the future is expected to be more dynamic, interdisciplinary, and collaborative than in the past, requiring transversal competencies. Even today, as we witness technologies such as AI becoming more available, we can envision the importance of being able to evolve and adapt as some roles change and others become challenged. In economic and educational activities, the acquisition of these transversal competencies are often associated with "future readiness". Transversal competencies are defined as abilities that are applicable across various fields, disciplines, and contexts. These competencies are instrumental in an individual's ability to apply context knowledge through a variety of diverse situations. While there are a number of identified transversal competencies, the augMENTOR solution has focused on the 4Cs - critical thinking, collaboration, creativity and communication in order to support the learning process through the augMENTOR solution.

3.2 Assessing the 4Cs

After conducting an evaluation of the pilot's needs and carefully considering the technological affordances of the LMS to be used (Moodle), augMENTOR has decided to adopt the use of rubrics for the assessment of transversal competencies. A rubric is an assessment tool that consists of the assessed criteria as well as a number of Performance Level Descriptors (PLD). These descriptors are defined at varying levels that correspond to the learner's mastery of said criteria. The use of rubrics in the assessment of the 4Cs offers several advantages over traditional assessment strategies, which can struggle to measure the fluid, nuanced, and contextual nature of transversal competencies.

Rubrics are also useful for distinguishing the differences between their specific and generic aspects of the 4Cs. Specific aspects refers to the learner's ability to engage in a particular 4C component within a given context, while the generic aspect refers to the broader, transferable competencies that are expected to be leveraged across a number of different scenarios and domains. For example, an educator responsible for developing a new lesson for a unique audience or need would fall under the specific aspect while that same educator's ability to generate original ideas and innovate, absent of a specific context, could be seen as falling under the generic aspect. Understanding the distinction between these two aspects is key to fully understanding and assessing the 4Cs in educational contexts. Within the augMENTOR solution, we defined three components for each of the 4Cs allowing us to create

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the necessary performance indicators. This in turn allowed us to define the PLDs that we would use to assess pilot results (D4.3).

Through a series of participatory design workshops between augMENTOR pilots and the project pedagogical experts, our team designed a set of rubrics to facilitate the pilots in assessing the 4Cs in the framework of their courses. To better support the pilots, through the work done in WP4 "Critical Thinking and Creativity", our team also produced a set of short printable guides that offer practical guidelines to educators about integrating and assessing the 4Cs in their every teaching (available in the project's website[1]).

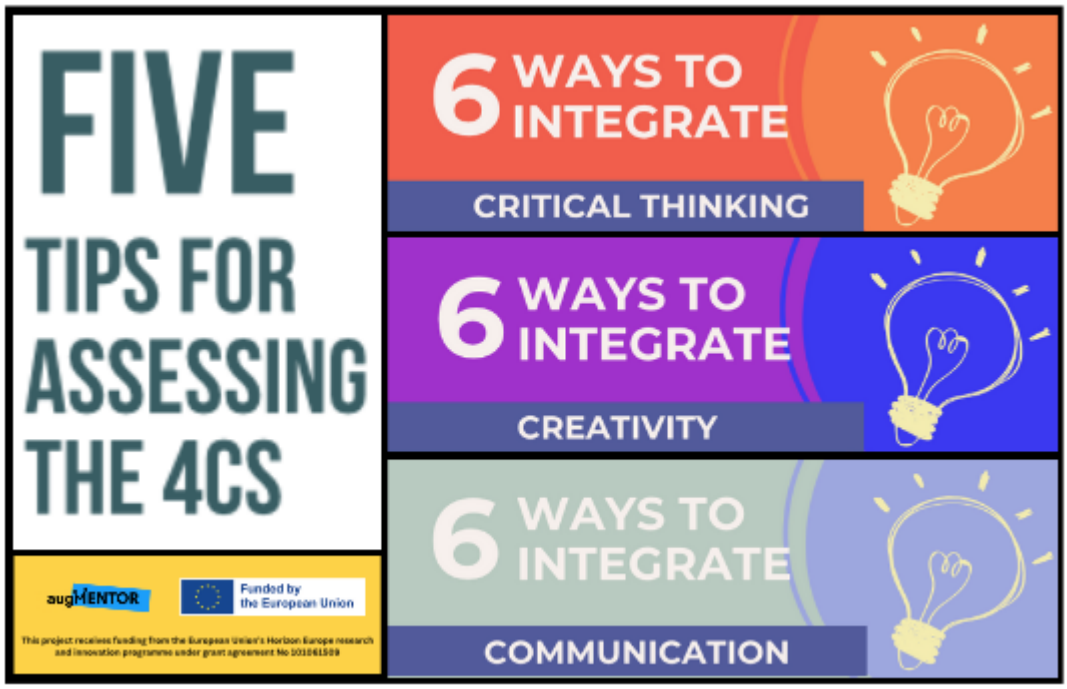

Figure 2. Short printable guides for educators about integrating and assessing the 4Cs

[1] https://augmentor-project.eu/wp-content/uploads/2024/12/Tips-for-Assessing-the-4Cs.pdf

3.3 Policy Recommendations and Implementation Strategies

A brief summary of the recommendations below is also included in the leaflet presented in the Annex

3.3.1 Policy Recommendations for Stakeholders and Policy Makers at the International Level

Establish Global Benchmarks

Policy Brief: To facilitate the integration of transversal competencies through the augMENTOR solution, we firstly identified the main transversal competencies of the international frameworks of the 21st century skills (D4.1) and the we focused on the 4Cs conducting a thorough literature review to identify the main components of each competency (D4.3)

Implementation Strategies:

- Develop further cross-national pilot programs to test the augMENTOR framework in different educational contexts.
- Continue to publish findings and associated case studies to promote best practices and encourage iteration around the augMENTOR solution.

3.3.2 Policy Recommendations for Educators, Trainers and Educational Organisations

Encourage Professional Development Around the 4Cs

Policy Brief: The augMENTOR framework and toolkit are tools that support the work of skilled educators. To ensure that these educators have the skills and confidence to integrate the augMENTOR framework into their teaching practice, we recommend the delivery of ongoing training sessions covering the use of the project's tools, creative pedagogical approaches, and the integration and assessment of the 4Cs. This training could come in the form of workshops, online courses or organised professional development and may derive from existing or custom made resources.

Implementation Strategies:

- Support the creation of training materials, quick-start guides, and other resources tailored for educators at differing experience levels.
- Setup collaborative spaces online where educators from around the world can share their experiences and insights about implementing the augMENTOR solution.

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- Develop a certification around the augMENTOR solution and provide incentives for educators who achieve it. Collect the best practices from these certified educators and make them available through a repository.
- Provide ongoing support through Q&A sessions, social media channels, and discussion forums.

Foster Personalised Learning

Policy Brief: Encourage educators to leverage the rubric-based data from the augMENTOR solution to tailor teaching strategies and personalise learning experiences.

Implementation Strategies:

- Use the data generated from the augMENTOR tools to identify learning activity based on the Learner Model (LM) of the augMENTOR solution.
- Combine rubric metrics with formative assessments to evaluate learners' activity in relation to the 4Cs.
- Using a data-informed approach, design targeted interventions to support teachers in regulating their activity in support of struggling students and high achievers.
- Supporting teacher agency through the information provided by the augMENTOR solution.

Iterate through Feedback Loops

Policy Brief: Support ongoing teacher and learner development through the use of augMENTOR-driven insights, feedback, peer observations and other learning analytics.

Implementation Strategies:

- Establish post-assessment meetings with learners to discuss augMENTOR generated learning analytics, provide feedback, and set improvement goals.
- Conduct routine reviews of the augMENTOR rubrics to judge their effectiveness and relevance. Encourage ongoing iteration to ensure alignment with learning objectives.
- Encourage learners to provide their experiences and feedback around the use of augMENTOR tools and rubrics. Use this data in your rubric review process to capture unique insights and retain the learner's voice.

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ANNEX - Second policy brief brochure

augMENTOR

Augmented Intelligence for Pedagogically Sustained Training and Education

Policy Brief 2 - December 2024

CORE PEDAGOGICAL STRATEGIES IN AUGMENTOR

ADAPTIVE LEARNING & PERSONALISED EDUCATION

augMENTOR seeks to empower both students and educators, using AI-driven technology to make informed decisions about the learning process. Using the student's activity profile and the analysis of the learners' activity (learning analytics), the augMENTOR solution can track progress and refine learning progression paths to meet the needs of each student.

TRANSVERSAL SKILLS THROUGH AI

4 C's

Leveraging advancements in Hybrid Intelligence (HI), which combines human and AI strengths, augMENTOR supports the 4Cs (Communication, Collaboration, Critical thinking, and Creativity). Our AI-based solution helps teachers and learners assess and regulate learning activities effectively, enabling more complex objectives through human-AI collaboration.

INTEGRATING AI IN PEDAGOGICAL APPROACHES

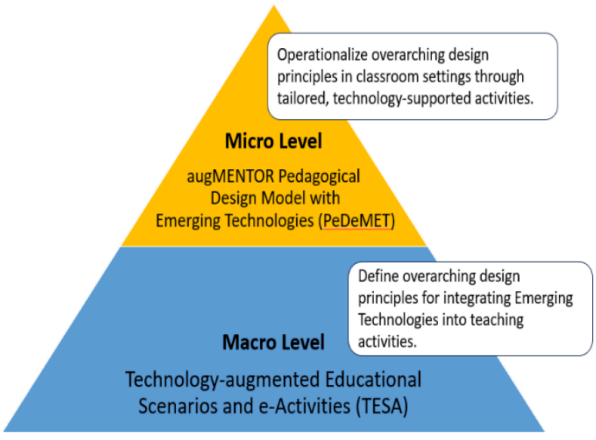

Figure 1. Pedagogical Framework Structure

The augMENTOR Pedagogical Framework integrates AI into education by addressing gaps in existing models like Technological Pedagogical Content Knowledge (TPACK) and ADDIE. Drawing on Activity Theory and creative pedagogy principles, the **framework balances technological and pedagogical dimensions to enhance teaching and learning**. It introduces TETPACK, incorporating Emerging Technologies into teacher competencies, and Technology-augmented Educational Scenarios (TESA), a data-driven model for classroom-level practices. By combining theoretical insights with practical applications, the framework fosters cohesive, technology-enhanced learning experiences. Its holistic approach considers educators, learners, content, and context, offering innovative tools to create meaningful, outcome-focused educational interventions.

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Policy Briefs & Implementation Strategies

SUPPORT THE INTEGRATION OF EMERGING TECHNOLOGIES (ET), AND ENHANCE EDUCATORS' ABILITIES TO USE AI IN ENRICHING LEARNING EXPERIENCES

Educators need comprehensive training to integrate Emerging Technologies and AI into teaching effectively. The augMENTOR Pedagogical Framework addresses this need by ***combining theory and practice to foster innovative, inclusive, and ethical teaching methods.*** *Aligned with the EU AI Act, it emphasizes AI literacy and responsible use, mitigating risks like bias and misinformation while unlocking AI's potential for personalized learning. Through professional development, mentorship, and practical tools, augMENTOR equips educators to navigate regulatory challenges, enhance teaching practices, and create impactful, technology-driven learning experiences. To successfully train educators with the Pedagogical Framework created, a set of key methods need to be applied.*

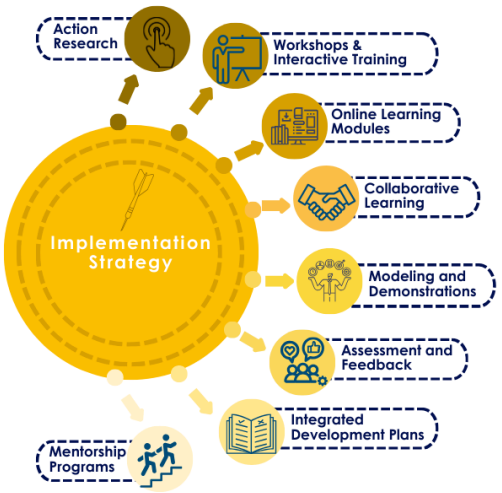

Figure 2. Key methods to implement the augMENTOR Framework.

EMBEDDING AI IN EDUCATIONAL PROGRAM DESIGN

Integrating AI and Emerging Technologies into education requires more than training educators — it necessitates ***updating curricula to embed AI in program design****. The augMENTOR Pedagogical Framework provides guidelines to address cognitive, instructional, and technological needs, ensuring AI tools foster essential competencies like creativity, critical thinking, and collaboration.*

The augMENTOR Pedagogical Design Model with Emerging Technologies (PeDeMET) offers a holistic curriculum redesign approach, integrating elements such as:

- ***Needs Analysis*** *to assess cognitive and instructional requirements.*
- ***Content Delineation*** *to align educational themes with learner needs.*
- ***Tool Integration*** *for effective use of AI and ICT in teaching.*
- ***Outcome Identification*** *focusing on knowledge and the 4Cs.*
- ***Learning Strategies*** *rooted in creative pedagogies.*
- ***Assessment Methods*** *emphasizing feedback and continuous improvement.*
- ***Contextual Placement*** *ensuring relevance to real-world environments*

SUPPORTING AI-ENHANCED PEDAGOGICAL TOOLS

The augMENTOR Pedagogical Framework supports integrating AI tools into education to enhance teaching, foster student engagement, and develop transversal competencies. Key challenges include educator readiness, infrastructure gaps, ethical concerns, and curriculum alignment. Recommendations include:

- ***Educator Training****: Provide specialized AI training, focusing on PeDeMET and TESA models, and improve AI literacy.*
- ***Infrastructure Development****: Equip schools with devices, software, and reliable internet while collaborating with developers to align tools with augMENTOR methodologies.*
- ***Ethical AI Use****: Ensure data privacy, eliminate biases, and support inclusivity.*
- ***Curriculum Integration****: Align AI tools with competency-based learning goals and facilitate adaptive learning experiences.*

Implementation strategies emphasize professional development, infrastructure enhancement, ethical AI deployment, stakeholder engagement, and continuous feedback to refine practices.

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Introducing 21st century skills in the learning process

The augMENTOR framework emphasizes integrating 21st-century skills, **focusing on the 4Cs: Critical thinking, Collaboration, Creativity, and Communication.** These transversal competencies are vital for future readiness and adaptability in dynamic, interdisciplinary workplaces. To assess the 4Cs, augMENTOR employs **rubrics, participatory design workshops practical guides** to help educators integrate and evaluate the 4Cs within their courses. This approach ensures nuanced, context-sensitive assessment and supports the broader application of transversal competencies in diverse learning scenarios.

FIVE TIPS FOR ASSESING THE 4CS

Policy Briefs & Implementation Strategies

INTERNATIONAL STAKEHOLDERS & EDUCATIONAL POLICY MAKERS

ESTABLISH GLOBAL BENCHMARKS

To facilitate the integration of transversal competencies through the augMENTOR solution, we firstly identified the main transversal competencies of the international frameworks of the 21st century skills and thev we focused on the 4Cs conducting a thorough literature review to identify the main components of each competency.

IMPLEMENTATION STRATEGIES

- Develop further cross-national pilot programs to test the augMENTOR framework in different educational contexts.
- Continue to publish findings and associated case studies to promote best practices and encourage iteration around the augMENTOR solution

EDUCATORS, TRAINERS & EDUCATIONAL ORGANISATIONS

ENCOURAGE PROFESSIONAL DEVELOPMENT AROUND THE 4CS

To enhance educator proficiency in using the augMENTOR framework, ongoing training is recommended through workshops, online courses, and professional development sessions. Strategies include creating tailored resources, establishing collaborative online spaces, offering certifications with incentives, collecting best practices, and providing ongoing support via Q&A sessions, social media, and forums.

FOSTER PERSONALISED LEARNING

The augMENTOR solution enables educators to personalise learning by leveraging rubric-based data and formative assessments. By aligning teaching strategies with the Learner Model, educators can design targeted interventions, support struggling students, and empower high achievers. This data-informed approach fosters teacher agency and enhances the focus on 4Cs competencies in personalised learning.

ITERATE THROUGH FEEDBACK LOOPS

Support teacher and learner development by using insights, feedback, and learning analytics. Conduct post-assessment meetings to review analytics, provide feedback, and set goals. Regularly review and update augMENTOR rubrics to maintain their effectiveness and alignment with learning objectives. Incorporate learner feedback on augMENTOR tools and rubrics into the refinement process, ensuring their experiences and perspectives are included.

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LEARN MORE

Visit the extended version of this policy brief to find more information about:

- Dedicated strategies about implementing the presented briefs
- The introduction of AI in educational settings
- Current EU policies and trends.

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