XR SENSITIVE SCENARIOS: DESIGNING AESTHETIC LANDSCAPES TO FOSTER PROBLEMATIZING SKILLS ABOUT ARTIFICIAL INTELLIGENCE

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ABSTRACT
This paper introduces XR Sensitive Scenarios as a pedagogical framework for designing semi-immersive learning landscapes that foster problematizing skills through aesthetic experience. The framework is illustrated through the Gaia Sensitive Scenario, developed to promote primary pupils' critical understanding of Artificial Intelligence. Preliminary findings suggest that SXR environments support ethical reasoning and the revision of anthropomorphic misconceptions about AI.

KEYWORDS
XR Sensitive Scenario; Problematizing Skills; Artificial Intelligence.

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1. Introduction

Recent advances in Extended Reality (XR) are profoundly transforming the design of educational environments, shifting attention from the technological affordances of immersive systems to their pedagogical potential. While a growing body of research has explored XR as a means to enhance motivation, engagement and conceptual learning, comparatively less attention has been devoted to its capacity to foster higher-order reflective processes, particularly those related to problematization, ethical deliberation and the revision of misconceptions. This gap becomes especially relevant in relation to Artificial Intelligence (AI), whose rapid diffusion is accompanied by widespread anthropomorphic misconceptions and simplified representations among children. Starting from this challenge, the present paper proposes a pedagogically grounded reinterpretation of semi-immersive XR environments through the concept of XR Sensitive Scenario. Building on Dewey's aesthetic education, Montani's techno-aesthetics and recent developments in XR learning environments, the article introduces the theoretical framework underlying the Gaia Sensitive Scenario and discusses the first empirical evidence concerning its potential to foster questioning, ethical reasoning and critical understanding of AI in primary education.

2. Aesthetic Education and XR Environments

The education of aesthetic sensibility has a long and authoritative tradition in the field of pedagogy. Undoubtedly, one of its most influential voices is John Dewey. In the final and most mature phase of his scholarly work, the American philosopher and educational theorist identified aesthetic experience as the privileged path for the education of *aisthesis*. In *Art as Experience* (1980), he defines *aisthesis* as the human perceptual capacity through which experience and the world are grasped first and foremost through one's own sensibility (that is, captured by the senses and "filtered" through the feelings they evoke). The sensibility to which Dewey refers is not a mere emotional (physiological) reaction. Rather, it is specifically recognised as "affective thought" (2024, p. 151, emphasis added). Through it, the individual encounters experience and the world not only to observe them (thus describing and knowing them), but also to interpret them on the basis of what he or she feels and thinks, and to imagine them (and make them) different from what they are, thereby expanding their beauty, justice, and sustainability.

In reconstructing the paths for the education of *aisthesis*, the philosopher situates himself within the context of the elementary school and refers to

artistic educational activities of a pictorial, expressive (for example, poetic), and technical-craft nature. "Art" (that is, human creative work) represents an exemplary educational experience because it cultivates a form of thought that is not exclusively logical-rational. Rather, it is a form of thought capable of "imagination", that is, able to achieve the "perception of the union of the possible with the actual" (Dewey, 1980, p. 349, emphasis added), the point of conjunction between what already exists and its possible further and better development.

It is precisely this Deweyan conception of aesthetic-artistic experience that finds an important opportunity for renewal and further development in the more recent work of Pietro Montani (2014, 2025). Drawing on Gilbert Simondon's notion of techno-aesthetics (2017) and bringing it into dialogue with John Dewey's pedagogical aesthetics, Hannah Arendt's theory of aesthetic-political judgment (1989), and recent developments in Extended Reality (García-Saldes, Cano & Muñoz La Rivera, 2026; Liu, Toreini & Maedche, 2025), the Italian philosopher redefines aesthetic-artistic experience as a "semi-immersive techno-aesthetic experience". This form of experience identifies semi-immersive artistic virtual environments as privileged spaces for developing educational and transformative pathways capable of fostering what Montani calls "interactive imagination". In line with Dewey's perspective, interactive imagination is the distinctively human faculty through which individuals enter a phenomenological relationship with reality, perceiving, through the senses, its characteristics, structures, contradictions, limitations, and transformative potential. Interaction with experience (including events, living beings, and artefacts) activates a problematizing disposition that critically re-examines reality, its misconceptions, partial understandings, errors, and injustices, and lays the foundations for its transformation.

An example of these semi-immersive artistic virtual environments is provided by the "Sensitive Environments" created by the Milan-based artistic research group *Studio Azzurro* (Cirifino et. al., 1999). These environments were designed for an adult audience and are defined as "sensitive" because of their potential to foster sensory and emotional immersion. They are also described as "sensitive" because they stage "sensitive" issues, that is, delicate, complex, and problematic themes (such as violence, conflict, sustainability, and social justice), approached from an ethical and value-oriented perspective[1].

According to Montani (2014), artistic semi-immersive virtual environments foster sensibility in relation to equally "sensitive" issues when they possess four fundamental characteristics: irreducibility, resistance, unpredictability, and genuine interactivity. These are environments whose images and symbols

cannot be interpreted in a single, unequivocal way and therefore resist attempts at definitive understanding and interpretation. They can be explored through non-predetermined pathways and enable genuine interaction between the explorer/visitor and the environment, since the environment is transformed by the person's passage, while the person, in turn, is potentially transformed through immersion in the environment[2].

Building upon this theoretical framework, a first phase of international research was carried out within the CAIRƐ International Research Project[3], developed in partnership with Middlesex University London and the West University of Timișoara. The study adopted a participatory action research approach (Barbier, 2008; Sorzio, 2019; Stenhouse, 1975), while data were analysed qualitatively using content analysis and reflexive thematic analysis (Braun & Clarke, 2006; Braun et al., 2018). The research objectives were: (a) to design and implement a semi-immersive techno-aesthetic experience for primary schools; and (b) to investigate the potential of this XR experience to foster children's problematizing skills (the ability to identify and critically revise misconceptions and stereotypes, and to recognise the limits and potential of socio-technological phenomena) as well as their ethical deliberation skills, understood as the capacity to formulate shared regulatory principles for the responsible management of AI-driven digital transformation (Guarcello & Longo, 2024; Guarcello, in press).

The design of the environment was initiated at the LIFE Laboratory of the University of Turin during the 2022–2023 academic year by a multidisciplinary team comprising university lecturers and researchers in general and experimental pedagogy, sociology, law, and fine arts, research technicians, and primary school teachers. Particular attention was paid to children attending primary school between the ages of 8 and 11. During the 2023–2024 and 2024–2025 academic years, the environment was experienced by approximately 500 fourth- and fifth-grade pupils from 23 classes across six comprehensive schools in the Turin area (Italy), with the support of approximately 50 teachers and 4 researchers.

The analysis and evaluation of the educational process and of the skills acquired by the children at the end of the activities (Guarcello et al., 2025; Guarcello, in press) enabled the refinement of the virtual environment and the theoretical revision of Montani's model, originally developed within a philosophical framework and addressed to an adult audience. Consequently, a new pedagogy centred, child-oriented, and teacher-friendly proposal, named *Gaia*, was developed. The proposal specifically focuses on primary education

and on the topic of AI-driven digital transformation (Abramowicz, Kowalkiewicz & Węcel, 2025).

3. "Sensitive-Extended Reality" (SXR): a new “virtual landscape” for education

Within the theoretical framework of “Gaia”, the revised virtual environment was developed as a form of Extended Reality that may be referred to as Sensitive-Extended Reality (SXR). It can be defined as an art-based, techno-aesthetic, semi-immersive virtual landscape, conceptualised as a Sensitive Scenario (Guarcello, in press). This scenario is "sensitive" for three main reasons. These reasons concern what, where, and how it stages (hence the term "scenario") a lived space and time to be inhabited. In other words, it is a landscape (Council of Europe, 2000) in which participants are invited to perceive, reflect, and deliberate together, as a group, on the issue represented within the scenario.

Firstly (what it stages), the scenario is "sensitive" because it stages sensitive issues concerning the well-being of humans, non-humans, and the planet (e.g. social and gender equality, environmental sustainability, and the critical use of technologies and Artificial Intelligence).

Secondly (where it stages), precisely because the Sensitive Scenario stages issues concerning the destiny of humans and the planet, it takes the form of an aesthetic-pictorial representation of Gaia, the living Earth (Latour, 2017; Lovelock, 1979). Gaia is represented through its main material states solid (rocks and minerals), aerial (the atmosphere), and liquid (the hydrosphere), and through its terrestrial habitats (mountains, hills and forests, grasslands, deserts), aquatic habitats (rivers and seas), underground rocky environments (caves), and anthropized environments (technologically modified by humans). The planet and its natural, animal, and human elements are translated into aesthetic-pictorial images designed to match the sensibility and interests of children aged 8 to 11. Immersion in this landscape is intended to foster in children an awareness of our existence within a shared Earth, with which we share a common destiny, because both living beings (humans, or Earthbound beings) and the living Earth are engaged in a continuous and reciprocal process of transformation: the living Earth changes by being inhabited, while transforming those who inhabit it.

Thirdly (how it stages), the SXR Scenario is "sensitive" not only because of its multisensory nature, but above all because it awakens, nurtures, and exercises *aisthesis*, that is, human perceptive sensibility. It enables children to engage

with the issues ("sensitive problems") not through their explanation or rationalisation, but through immediate and subjective affective contact. Through this form of engagement, children (always working in small groups rather than individually) can explore the scenario in search of different "clues" that enable them to reconstruct the sensitive problem by:

– grasping the overall meaning of the problem,

– discerning its details,

– perceiving its shadow areas, limitations, and transformative potential (its "beauty"), and then reflecting critically upon them,

– experiencing, expressing, and comparing their own judgement of taste, that is, their personal, creative, and immediate deliberation on the problem,

– expressing and revising misconceptions and prejudices that emerge through immediate perceptual engagement with the sensitive problem,

– developing their own value judgement (ethical deliberation) on the problem by imagining the possible perspectives and needs of those who may be affected by it, both in the present and in the future,

– deliberating shared evaluations and decisions concerning the problem and its management.

To qualify as a Sensitive Scenario, the landscape incorporates at least seven fundamental structural elements, which extend Montani's model by revising it from a pedagogy-centred, child-oriented, and teacher-friendly perspective:

1. contraction: the landscape is experienced through the person's "sensory incorporation" within it,

2. contemplation: the landscape is explored through a contemplative and analogical approach,

3. resistance: the landscape resists the subject's passage, creates friction, and stimulates "fatigue" and expectation,

4. irreducibility: the landscape presents pathways and pictorial contents that do not allow a complete and definitive understanding,

5. unpredictability and contingency: the landscape offers non-predetermined pathways in which trajectories and destinations are defined by the person in the here and now, in a unique and unrepeatable way,

6. genuine interactivity: the landscape offers opportunities for authentic interaction, enabling people to modify the landscape while being transformed by their exploration of it,

7. intersubjective relationships: the landscape supports group exploration, dialogue, and confrontation.

The landscape thus takes the form of a human geographical space to be explored and inhabited, while remaining impossible to exhaust, codify, or fully comprehend[4]. Human beings explore a broad Sensitive Scenario that they will never be able to survey in its entirety and within which they do not move through an avatar. Rather, the human being is made present only through the anthropic traces left within the solid, aerial, and liquid dimensions of the landscape and through the feeling of "being inside" this ecosystem, as a living human interacting with artefacts and non-human living beings. A living being among other living beings, small and "relatively significant" in the presence of a majestic Earth. At the same time, however, the human being differs from all other living beings because it is the only one endowed with a conscious and intentional gaze upon the ecosystem of living beings.

For this reason, the landscape is not a cartographic representation drawn from the "viewpoint of Sirius" (Camus, 1955; Renan, 1892) or from a "view from nowhere" (Nagel, 2018). Rather, the landscape is a lived space, explored from a particular point of view: that of human beings who, together and within a specific spatio-temporal situation, move through the scenario without any predetermined route, making choices in the here and now while remaining closely connected to the vitality and subjective perception of experience. For this reason, the landscape is not immersive but semi-immersive. Indeed, it is intended to preserve:

– authentic interaction among people exploring the landscape in small groups and from an intersubjective perspective;

– a continuous relationship and exchange between the real and the virtual. The aim is to enter, through the senses, the virtual world of Gaia while remaining firmly grounded in one's own planet, territory, and local community, as well as in the spatio-temporal coordinates of real existence.

According to Giuseppe Dematteis (2021), a landscape reconstructed in this way enables its explorers to engage with the environment "intelligently and lovingly" (p. VIII, our translation), to problematise it, revise common-sense understandings of it, imagine it differently, and enhance its qualities. Fundamentally, the geographer argues, this means uncovering the conditions

for its possible becoming. From this perspective, the landscape transcends the narrow boundaries of the "virtual environment" and instead assumes the features and character of what could more appropriately be defined as a "poetic-imaginative landscape".

4. The “Gaia” Sensitive Scenario: fostering skills for AI

The art-based techno-aesthetic semi-immersive virtual environment, designed within the framework of the CAIRƐ International Research Project and subsequently revised into the “Gaia” XR Sensitive Scenario during the 2024–2025 academic year, is based on XR technology and originates from a two-dimensional digital painting subsequently developed into a three-dimensional environment. It is experienced by children, working in groups of seven to eight participants, in a semi-immersive setting under the guidance of a trainer-researcher, using 3D glasses equipped with spatial tracking sensors and a pointer.

The present version of the SXR “sensitive scenarios” has been created using 3D modelled objects in Blender. The objects were derived from the 2D digital painting and “solidified” with the aim of maintaining the original illustrative effect. The virtual landscape itself was created in Unity 3D and integrates the technologies that deliver a semi-immersive experience. These technologies synchronize the 3D glasses with the stereoscopic projection on a large “virtual wall” providing a spatially referenced user experience from both visual and auditory perspective. The stereoscopic projection creates two distinct images, one aimed at the left eye and another at the right one, to recreate a sense of depth.

The virtual landscape is organised into two levels. The first, external level is represented by a mountain with human features (Latour, 2017) and by the natural environment surrounding it. The second, internal level is represented by a cave located within the mountain. The two levels are explored by the children during two separate educational sessions, held approximately one week apart. Each exploration is followed by an activity aimed at fostering the children's cognitive-reflective mastery of the contents and thought processes experienced during immersion (Bruner, 1996). In addition, the children take part in a third activity which, on the first day, focuses on technological innovation in its broadest sense and, on the second day, on interaction with AI-embedded agents[5].

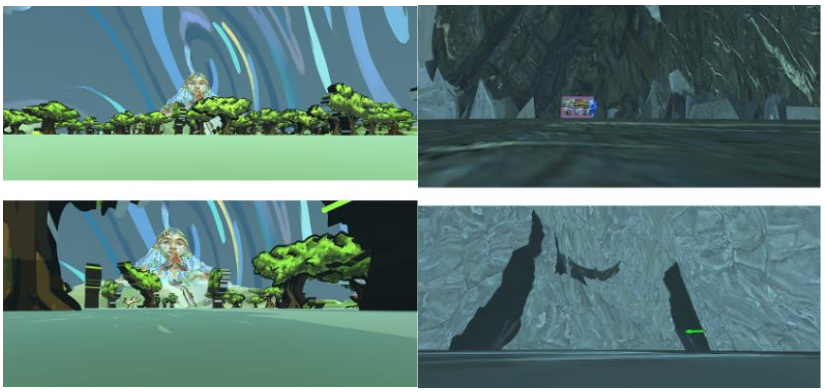


Figure 1: Gaia “sensitive scenario”: the Levels[6]

The first, external level of the Sensitive Scenario is intended to represent, in pictorial form, Gaia, the living Earth, within which children have the impression of being incorporated and which they explore through contemplation. This Gaia is composed of pictorial and sound environments distributed across different terrestrial material states and natural habitats (the mountain, meadows, and hills), aerial environments (the sky), and aquatic environments (the sea and waterfalls). These habitats are developed as a continuous whole within a vast virtual landscape that cannot be fully explored within the time available for the activity. Consequently, it resists any attempt at the immediate appropriation of places or at a definitive interpretation of the contents and images that animate it, which therefore remain irreducible.

Children explore the different habitats freely (thus experiencing unpredictability and contingency) and, at a later stage, by using an interactive map that "teleports" them to six different locations: the mountain, the hill, the beach, the agora, the grove, and the sky. The exploration is aimed at identifying clues to the process of anthropisation (that is, the technological transformation) of places by human beings. The forms of anthropisation presented in the landscape share a specific characteristic: they consist of technological interventions that have introduced innovations into the living ecosystem, enhancing both the functionality and the quality of human existence. The technological interventions that children discover throughout the landscape are: cave paintings, the boat, the hot-air balloon, the swing, the agora, and a grove partially generated through Artificial Intelligence.



Figure 2: "Gaia" sensitive scenario: the habitats and clues

Children explore this first, external level of the Sensitive Scenario over the course of a one-hour session, working in small groups under the guidance of the researcher and in the presence of their classroom teacher. The researcher begins the experience by encouraging the children to explore the landscape freely (having first observed its two-dimensional pictorial representation on paper) in search of six clues representing technological innovations developed by humans from prehistory to the present day. The researcher further encourages the children to engage with their own sensory perceptions by inviting them to reflect on how they feel "inside" this living Gaia, how they perceive the landscape, what it means to them to be "inside a painting", where they feel drawn to go, and what arouses their sense of wonder and captures their attention.

Throughout the exploration, the researcher facilitates the process by maintaining the focus on sensory perception and encouraging inquiry into the clues of technological innovation, without providing predetermined answers or interpretative frameworks. Upon reaching each area of the Sensitive Scenario, the researcher fosters intersubjective dialogue within the group concerning:

– what the clue of technological innovation might be,

– why it represents a technological innovation,

– in what ways it has enhanced the functionality of human existence (what it is used for) and improved its quality (what it means for human life),

– what forms of harm its irresponsible use may cause to the Earth.

Each clue is connected to topics and issues addressed in the primary school curriculum, particularly within the humanities and social studies from the third to the fifth grade, so that children can mobilise their previously acquired cultural knowledge and use it as a basis for reflection, discussion, and shared deliberation.

The second, internal level of the Sensitive Scenario is represented by a cave located within the mountain. The cave is reached by ascending towards the mountain summit and constitutes the exploratory space dedicated to the specific topic of Artificial Intelligence, understood as one of the most recent and widely debated technological innovations (Guarcello, 2025a). Inside the cave, children search for a series of questions and answers (Q&A) concerning the meaning and functioning of AI, with particular attention to some of the most common misconceptions identified in the following domains (Airenti, 2015; Bewersdorff et al., 2023; Mertala & Fagerlund, 2024):

1. Non-technological AI: AI is conceptualised as a human cognitive process; for example, AI is believed to think or to possess an intelligence that has not been created by humans,

2. Anthropomorphised AI: AI is conceived as a human-like entity; for example, it is believed to be a person capable of experiencing emotions, intentions, and free will,

3. Hyper-human AI: AI is conceived as an entity capable of conquering the world, reading human minds, negatively affecting human physiological functions (e.g. "shrinking the brain"), never making mistakes, and so forth.

Children are invited by the researcher to collaboratively reconstruct the answers to each question and to verify them by listening to informative and/or process feedback (Nicol & Macfarlane-Dick, 2006), accessed by clicking on the corresponding question.

The exploration of the cave concludes with a final task. Children are invited to deliberate on the two most serious forms of harm that, in their view, could be inflicted upon Gaia through the irresponsible use of Artificial Intelligence, the two greatest benefits that AI could bring to Gaia if used responsibly, and a "law" that should be enacted to ensure that AI is designed and used for the benefit of Gaia (Guarcello, 2025b). Children work collaboratively on these deliberations with the support of Alpha Mini, an AI-enabled humanoid artificial agent.

At the end of the exploration, however, the Gaia landscape is no longer the same. On the one hand, it has acted upon the children by potentially fostering a perceptual and reflective transformation in relation to AI. On the other hand, the children themselves have concretely transformed the landscape, in accordance with the structural principle of genuine interactivity. More specifically, each group of explorers is guided by the researchers to imagine a "great dream" of AI-based technological innovation. Why a great dream? Because the children are invited to envision an innovation so improbable ("great") that it is currently considered impossible. At the same time, this innovation is conceived as having the potential to greatly enhance the quality of children's lives on Gaia one thousand years into the future ("dream"). The design of this great dream, together with its meaning and technical plan, is narrated by the children through a voice message, which is then placed in the agora within an image representing the "character" chosen by each group of explorers as their companion during the immersive experience. As each new group completes the activity, the agora gradually becomes populated with new characters and great dreams of innovation, changing its form, expanding its meanings, and being continually revitalised by the children's countless interpretations of possible worlds inscribed within the landscape.

5. Revising misconception on AI: Research findings and discussion

The implemented version of the “Gaia” Sensitive Scenario was tested during the 2025–2026 academic year with approximately 130 fourth-grade pupils from two comprehensive schools in Turin (Italy), supported by 20 teachers. Within the framework of the CAIRɛ International Research Project, the primary objective of this new research phase was to investigate the problematizing and deliberation skills that can be fostered through the Sensitive Scenario in relation to children's knowledge and misconceptions about the topic addressed in the virtual environment. Learning outcomes were evaluated through the qualitative and quantitative analysis of two pre- and post-intervention questionnaires administered at the beginning and at the end of the educational activities. The first questionnaire, administered on both training days, explored children's understanding of examples, meaning, limitations, potential, and "rules of conduct" concerning technological innovation, Artificial Intelligence, and its use in everyday life, learning, and work. The second questionnaire, administered on the second training day, focused specifically on children's knowledge and misconceptions about Artificial Intelligence. The questionnaires were analysed through content analysis (Mayring, 2021).

Learning outcomes were also evaluated through the qualitative analysis of both the dialogues among children, teachers, and researchers recorded during the educational activities and the in-depth interviews conducted with the participating teachers after the educational experience. The dialogues and interviews were analysed using reflexive thematic analysis (Braun et al., 2018).

The present section discusses the findings emerging from the questionnaires on children's conceptions and misconceptions about Artificial Intelligence. These conceptions and misconceptions had already been addressed through a broader "sensitive reflection" during the first educational session and were subsequently explored in greater depth and more systematically during the second session through the Q&A activities with which children interacted inside the cave. The analysis of the questionnaires revealed children's level of understanding and the quality of their deliberation regarding seven statements about Artificial Intelligence. These statements were derived from misconceptions identified as particularly relevant in the literature (Mertala & Fagerlund, 2024) and confirmed by the findings of the research team's previous studies (Guarcello & Longo, 2024; Guarcello & Pileggi, 2025). Before their administration, the statements were reviewed by the primary school teachers involved in the project and subsequently piloted with fourth-grade pupils from their schools to verify their wording and comprehensibility. The seven statements were as follows:

1. When you talk to a robot or a conversational agent (such as ChatGPT or Alexa), it answers because it is connected to a person who is speaking or writing the answers to you at that very moment,

2. If you use Artificial Intelligence technologies too much, after a while your brain becomes smaller,

3. Examples of Artificial Intelligence technologies include robots and conversational agents (such as ChatGPT or Alexa), which can provide information very quickly but may also give incorrect information,

4. Some Artificial Intelligence technologies help human beings carry out their work (for example, when it is dangerous or physically demanding) and solve problems (for example, when very large amounts of information need to be stored and processed),

5. Artificial Intelligence technologies (such as robots or conversational agents) experience emotions exactly like human beings,

6. Artificial Intelligence technologies (such as robots or conversational agents) think exactly like human beings,

7. Artificial Intelligence technologies (such as robots or conversational agents) will be able to read people's minds and conquer the world.

Each statement was presented in the questionnaires by asking children to indicate whether they agreed, disagreed, or partially agreed with it. Whenever they selected either disagreement or partial agreement, they were invited to rewrite the statement in a way they considered more appropriate[7]. Analysis of the responses revealed improvements ranging from 23.9% to 51.5% between the pre- and post-questionnaires, depending on the statement[8]. In particular, the increase in correct responses (i.e., disagreement with the incorrect statements) was as follows:

– Statement 5: +23.9% (85.8% correct responses in the post-questionnaire),

– Statement 6: +29.1% (65.7% correct responses in the post-questionnaire),

– Statement 1: +35.1% (82.1% correct responses in the post-questionnaire),

– Statement 7: +38.8% (86.6% correct responses in the post-questionnaire),

– Statement 2: +51.5% (66.4% correct responses in the post-questionnaire).

Improvements were also observed for the statements that were already correct:

– Statement 3: +10.5% (from 82.8% correct responses in the pre-questionnaire to 93.3% in the post-questionnaire),

– Statement 4: +9.7% (from 73.1% correct responses in the pre-questionnaire to 82.8% in the post-questionnaire).

As can be seen, these two statements were already answered correctly by the majority of children in the pre-questionnaire. Consequently, the margin for improvement was smaller than that observed for the previous statements.

The qualitative analysis of the statements rewritten by the children in relation to statements 1, 2, 5, 6, and 7 enabled a more refined evaluation of the changes that occurred between the pre- and post-questionnaires. The analysis also considered rewritten statements in two additional cases: when children selected not only "disagreement" but also "partial agreement"; and when they selected the same response option (e.g. "disagreement") in both the pre- and

post-questionnaires, but showed an improvement in the quality of the rewritten statement in the post-questionnaire. This analysis revealed a substantially higher number of changes, in some cases almost twice as many:

– Statement 6: 47.1% (+18.0%),

– Statement 5: 55.15% (+31.25%),

– Statement 7: 56.0% (+17.2%),

– Statement 1: 60.1% (+25.0%),

– Statement 2: 65.6% (+14.1%).

Content analysis of the children's rewritten statements revealed improvements in:

– argumentation: providing explicit justifications for their statements,

– logical organisation: using logical connections (e.g. before/after, premise/consequence, if/then),

– problematization: presenting multiple plausible, and sometimes contrasting, interpretations of the same phenomenon,

– lexical precision: using terminology appropriate to the concepts and processes underlying Artificial Intelligence,

– confidence and rigour: expressing reformulations with greater confidence, clarity, and structural coherence,

– completeness: enriching the content of the reformulations,

– deontological perspective: formulating statements oriented towards responsible behaviour.

Most of the positive changes concerned the quality of argumentation, although several types of improvement were often present within the same reformulation. All but two children modified their responses between the pre- and post-questionnaires.

Overall, the exploration of the Sensitive Scenario, the educational activities associated with it, and the deliberative work carried out by the children through the seven questionnaire statements enabled them to reflect on two types of

conceptions, namely intuitive-cognitive ideas through which individuals make sense of the world (Mertala & Fagerlund, 2024):

– scientific conceptions: well-founded and evidence-based ideas, developed based on current knowledge about the phenomenon under investigation,

– non-scientific or quasi-scientific conceptions: naïve, common-sense ideas that express a partial and simplified understanding of the phenomenon (Vygotsky, 1987) and are not supported by scientifically grounded alternative explanations. This second category includes misconceptions that stem primarily from anthropomorphic representations of Artificial Intelligence. These constitute the most common misconceptions among the age group considered in this study and are also the most problematic in view of the widespread use of AI technologies in adult everyday life. Within the Sensitive Scenario (specifically, inside the cave), children explored three main categories of such misconceptions (Davis, 1997): non-technological AI, anthropomorphised AI, and hyper-human AI.

The "affective thought" elicited by the Sensitive Scenario enabled children to engage with the "AI problem" starting from their own subjective perceptions, preconceptions, and stereotypes concerning the meaning, functioning, and potential risks of Artificial Intelligence. In particular, the pre-questionnaires revealed that many children believed that AI-enabled artefacts:

– speak or move because they are connected to, or "contain", a human being,

– inevitably cause irreversible harm and physiological changes regardless of how they are used,

– are capable of reading human minds and conquering the world,

– experience and understand emotions exactly as human beings do.

By becoming aware of their own immediate ways of perceiving the "AI problem", children were able to critically re-examine those conceptions that they themselves came to recognise as inadequate when subjected to reflective analysis. The most substantial changes in children's deliberations concerned one of the two statements that achieved the lowest percentage of correct responses in the post-questionnaire: Statement 2 ("If you use Artificial Intelligence technologies too much, after a while your brain becomes smaller"). Among the children involved in the study, a strong perception emerged of the harm potentially caused by interaction with AI, confirming a predominantly alarmist view of these technologies.

An opposite trend emerged for the second statement with the lowest percentage of correct responses in the post-questionnaire: Statement 6 ("Artificial Intelligence technologies, such as robots or conversational agents, think exactly like human beings"). This statement showed both the lowest percentage of correct responses in the post-questionnaire and one of the smallest improvements between the pre- and post-questionnaires. The distinction between human thought and machine intelligence, as well as the inadequacy of the term *intelligence* to describe machine agency, proved particularly difficult for children to understand. Although this distinction is fundamental for understanding the meaning and functioning of Artificial Intelligence, it clearly requires more time and a more articulated educational pathway to be fully understood. Nevertheless, a substantial proportion of the children revised their initial position on the issue and, when improvements in the rewritten statements were also considered, approximately 50% of the participants successfully revised their initial misconceptions.

The highest percentage of correct responses in the post-questionnaire was obtained for Statement 7 ("Artificial Intelligence technologies, such as robots or conversational agents, will be able to read people's minds and conquer the world"). Although revising this misconception appeared less cognitively demanding, it remained equally important from an educational perspective. These misconceptions are highly persuasive for children and, if left unchallenged, may easily consolidate into perceptions of AI as a hyper-human entity, encouraging passive reliance on AI systems and an irrational overestimation of their capabilities. Similar risks emerge from anthropomorphic misconceptions, according to which AI is a person capable of experiencing and understanding emotions exactly as human beings do. Such misconceptions are particularly concerning in light of the expected widespread diffusion of AI-enabled technologies in everyday adult life by 2035 (MarketDataForecast, 2025; Mobility Foresights, 2025). Contemporary examples include the growing tendency to use ChatGPT as a therapist or to perceive avatars and humanoid robots as genuinely human entities capable of authentic understanding and reciprocal interaction.

6. Conclusion

The findings suggest that XR Sensitive Scenario may represent a promising pedagogical approach for designing immersive learning experiences aimed not simply at transmitting knowledge, but at fostering problematization, ethical deliberation and the revision of misconceptions through aesthetic engagement. This Scenario provides preliminary evidence that semi-immersive

environments can support children's development of reflective competences when embedded within structured educational pathways.

Future research will focus on extending the pedagogical framework beyond fixed laboratory installations by transferring the Gaia Sensitive Scenario to portable XR technologies, particularly smart glasses, capable of supporting authentic explorations directly within natural, cultural and educational settings. This transition will allow the Sensitive Scenario to evolve from a laboratory-based semi-immersive environment into a situated and mobile learning experience, opening new research perspectives on the relationship between embodied cognition, aesthetic experience and outdoor educational landscapes.

Ethical approval process

The study was conducted in accordance with established ethical standards for educational research involving children. Prior to data collection, informed consent was obtained from the parents or legal guardians of all participating pupils, and participation was voluntary. Children were provided with age-appropriate information about the activities and were free to withdraw at any time. All data were collected, processed, and stored in compliance with applicable data protection regulations, ensuring participants' anonymity and confidentiality.

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[1] See: https://www.studioazzurro.com/category/opere/ambienti-sensibili/

[2] An interesting example is provided by the artwork "Il confine dei corpi" (2021) by Studio Azzurro: https://www.studioazzurro.com/opere/il-confine-dei-corpi/

[3] CAIRƐ International Research Project: https://www.school4thinking.unito.it/home-page

[4] For this reason, the Sensitive Scenario takes the form of an art-based, techno-aesthetic, semi-immersive virtual landscape (rather than an environment). According to William J. T. Mitchell (2002) and Paolo Furia's reinterpretation of his work (2023), it is not a topography that reproduces places, but an inhabited space characterised by two fundamental features: it is to be lived (experienced, reflected upon, and interpreted) and it is alive (agentive and performative). Indeed, it is a space that "evokes impressions which are subsequently re-elaborated within the human imagination" (Furia, 2023, p. 61), activates interactions, involvement, and transformations, and thus participates agentively in the reshaping of new ecosystems of interaction between humans, non-humans, and the environment.

[5] See: https://www.school4thinking.unito.it/immersive-experience/research-work

[6] The images and the technical design were developed by Dr. Giorgio Borla (giorgio.borla@unito.it), Lab "LIFE" (https://www.laboratoriolife.unito.it/).

[7] Children with disabilities were administered an ad hoc questionnaire, which was not included in the present analysis. Children with specific learning disorders completed the standard questionnaire. No difficulties in understanding or completing the questionnaire were observed. Furthermore, no significant differences were found in response patterns compared with those of the other participants. A total of 128 questionnaires were considered valid for the present analysis.

[8] The analysis of the data collected during the activities carried out in the previous academic year revealed improvements ranging from 10% to 20% between the pre- and post-intervention phases, depending on the statement (Guarcello, in press).

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