CHILD-AITS RELATIONSHIP (C-AIRƐ). EDUCATING TO A REFLECTIVE AND CRITICAL RELATIONSHIP WITH AI TECHNOLOGIES IN PRIMARY SCHOOL

CHILD-AITS RELATIONSHIP (C-AIRƐ) EDUCARE A UN RAPPORTO RIFLESSIVO E CRITICO CON LE TECNOLOGIE DELL'INTELLIGENZA ARTIFICIALE NELLA SCUOLA PRIMARIA

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ABSTRACT

Children must be educated to discern the risks presented by new technologies as well as the humanizing function it can perform in our lives. The paper presents the training practice conceived within the University of Turin funded and led "C-AIRɛ" research project - in partnership with Middlesex University, London, and the West University of Timişoara - targeted at primary school children and realized through aesthetic experiences conducted with AI generated visual arts (Artivive Platform).

I bambini devono essere formati al discernimento tanto dei rischi delle nuove tecnologie quanto della loro funzione umanizzante. Il contributo presenta una pratica formativa ideata nel progetto di ricerca "C-AIRɛ" finanziato e condotto dall'Università di Torino – in partnership con la Middlesex University di Londra e con la West University di Timişoara - rivolto ai bambini della scuola primaria e realizzato attraverso esperienze estetiche di arte visiva generata con IA (Piattaforma Artivive).

Introduction

The human-technology relationship is one of the most noted, widespread and controversial issues in today's scientific debate. In fact, the diffusion of artificial intelligence technologies (AITs) is defined as radical (Malavasi, 2019) precisely because it does not concern only specific professional fields, but in reality is an integral part of daily life, starting from early childhood (Floridi, 2009, 2017, 2020). It penetrates daily life, bringing enormous potential in terms of expansion, increase, implementation and acceleration of existence.

At the same time, however, the problematicity of this interpenetration between human beings and AITs is equally evident (Fanizza, 2022; Malavasi, 2019; Rasetti, 2018; Revelli, 2020). AITs contribute, in fact, to generating and exacerbating complex phenomena such as hyper-connection, acceleration of social life, homologation, unique thought, synchronization and deresponsibilization of consciences (Abott, 2014; Stiegler, 1997, 2014, 2015; Vercellone, 2017).

These phenomena expose human existence to real risks. Risks associated, on the one hand, with the increasingly unlimited power of the human being to use technologies for the destruction of him/herself and nature as well as for the indiscriminate overcoming of the boundaries of the human condition (Borgna, 2022; Brooks, 2017; Turing, 1950). Risks connected, on the other hand, to the catastrophic eventuality of an overwhelming by the machine, which culminates - with Arendtian words – in the removal of the human being's own human stature (Arendt, 1963; Sorrentino, 2004).

Although the criticalities and dangers connected with these phenomena are clear and widely perceptible, the relationship between the human being and AITs has to be theoretically problematized. In fact, it has to be reconstructed with regard to its criticalities but also to its capacity to make human - more human - the existence of the human being. Although the complexity of the current relationship between human beings and technology is undeniable, it is thanks to this same relationship - the human-technology relationship - that the human being originally initiated and cultivated an extraordinary process of humanization of him/herself and the natural world (Ferraris, 2020, 2016, 2018; Remotti, 2011).

It is in fact the technological "prosthesis" (in the form of the stick, the stone and the flint, ...) that originally allowed human beings to make nature more hospitable from an operational-functional point of view (Visconti, Capozzi, Ferraris, 2022). This transformation of nature was a condition that made possible the birth and flowering of thought in the form of introspection, dialogue and sociality. In fact, Maurizio Ferraris states that «those who run in the savannah followed by a lion can hardly devote themselves to reflection», as well as «without elementary technical devices [...] such as the use of paper and pen, arithmetic operations of medium complexity would be precluded» (*Ibi*, pp. 48-49, our translation).

The deep understanding of both the critical issues and of these extraordinary humanizing potentialities - understanding necessary to focus on the training needs of the new generations - finds an interpretive lens of excellence (particularly authoritative, significant and promising) in the ecopedagogical study of the human-technical relationship.

1. Towards a Utopian Postdigital Ecopedagogy

The increasing use of AI in primary education presents the spectre of a dystopian future where children are dehumanised through an addiction to technology, where human teachers, demotivated by their progressive substitution by artificial intelligence applications, become uninspiring and uninspired technology facilitators and children, disconnected from their creatives selves, lose all sense of agency. There is also much debate around the concern that AI solutions could incorporate educational ideas reflecting the biases of their developers or distorted by dysfunctional algorithms. Furthermore, the immense amount of energy required to power the world's hunger for technology can only increase the threat to the planet caused by over-consumption. Many of these concerns are shared by The Council of Europe, who, though they state that AI offers many opportunities, highlights as well the many threats posed by the irresponsible and uncontrolled incursion of AI into children's education, to the extent that it makes it necessary to take human rights principles into account in the early design of its application (Council of Europe, 2019).

To such a possible dystopian scenario, a utopian ecopedagogy, drawing on authors like Paulo Freire, Danilo Dolci and Richard Kahn, can offer a remedy. Ecopedagogy seeks 'to interpolate quintessentially Freirian aims of the humanization of experience and the achievement of a just and free world with a future-oriented ecological politics that militantly opposes the globalization of neoliberalism and imperialism, on the one hand, and attempts to foment collective ecoliteracy and realize culturally relevant forms of knowledge grounded in normative concepts such as sustainability, planetarity, and biophilia, on the other' (Kahn, 2010, p. 18). Ecopedagogy is transformative teaching in which educators dialectically problem-pose the politics of socioenvironmental connections through local, global, and planetary lenses. It is therefore not only based on experiential education composed of activities in contact with nature but aims, as well, to develop tools to change and subvert this system of domination. Its main purpose is to educate children to face real everyday problems with action, creativity and dialogue to move towards sustainable growth, based on respect for nature, the rights of all, justice and a culture of peace. Freire's (2010) utopia, conceived as a path to an open future, the awareness of the imperfection of the unfinished human that results in his educability and perfectibility and Dolci's (1996) vision of a 'realisable' utopia, which means enabling children to discover the strength to express themselves and find the intuition for 'the new to be designed' can represent part of the solution.

Rather than fearing or shunning it, Freire embraced the use of technology in education and in the early 1990s set up the Central Laboratory for Educational Informatics in São Paulo, which made significant investment in digital equipment. From *Pedagogy of the Oppressed* (2017) onwards he makes the argument that it is not technology itself that is a negative force but the way that it is used or deployed (Freire, 2017)**.** Knowledge emerges only through invention and reinvention, through the restless, continuing and hopeful inquiry human beings pursue in the world, with the world and each other; and Freire saw technology as a useful tool that, if employed correctly, enhances this creative process.

Dolci had concerns about creativity being deformed by technology, which he believed had the potential to become the instrument of parasitism and destruction. His answer to this concern

was his Reciprocal Maieutics, the educational method he fostered, which is a dialectic method of inquiry that aims to foster the growth of consciousness by guiding the participants to listen to different points of view and focus on any contradictions that emerge. This method became the cornerstone of Dolci's ecopedagogy, built on the need to guide children as they develop into responsible adults, working towards the formation of a planetary citizenship based on dialogue and the relationships that exist between all the creatures that inhabit the Earth. His aim, through his Reciprocal Maieutics was to develop personal, group and collective creativity (Fontanelli, 1984), which he believed could be a means of working towards a future where, in many regions of the earth, communities were following the paths of research, dialogue, cooperation and solidarity in multiple forms of art and maieutic education (Dolci, 1997).

In *Critical Pedagogy, Ecoliteracy, and Planetary Crisis: The Ecopedagogy Movement* (2010), Richard Kahn presents a framework for ecopedagogy focusing on ecoliteracy programs both within schools and society. He writes about creating scholar-activist coalitions to promote ecopedagogies and dedicates a chapter to the relationship with technology arguing that 'in the political battles of the future, educators will need to devise ways to produce and use these technologies to realize a critical oppositional ecopedagogy that serves the interests of the oppressed, as they aim at the democratic and sustainable reconstruction of technology, education, and society itself' (Kahn, 2010, p. 72). He concludes that robustly critical forms of media, computer, and multimedia literacies need to be developed as digital subsets of a larger project of multiple technoliteracies. Critical media literacy not only teaches students to learn from media, to resist media manipulation, and to use media materials in constructive ways, but it is also concerned with developing skills that will help create good citizens and make them more motivated and competent participants in social life. Critical media literacy can be connected with the project of radical democracy as it is concerned to develop technologies that will enhance political mobilization and cultural participation. In this respect, it takes a comprehensive approach that teaches critical attitudes and provides experimental use of media as technologies of social communication and change.

This approach is imbued with the importance of critical thinking for the promotion in the child of active and responsible citizenship and that are sustaining, as Kahn says, of a life and creativity 'firmly grounded in a material and social understanding of our interconnected organic existence, as a starting place for classroom practice and political strategies for reinventing the world' (Kahn 2010, p. xv). This means bringing AI-supported creativity into play in the classroom, guiding children to engage soulfully in their work together and offering a perspective on art's function of awakening and enlightening us leading to the creation of new utopias, where creativity, as intended by Freire (2010), determines our being in and with the world, allowing individual identity to become collective subjectivity, encouraging true reflection and leading to action. This must be understood as part of a process of relational sensitivity since each one of us, as Dolci says, is capable through creativity of discovering 'the invisible, innumerable roots that reach out in every direction to connect us to the world' (Spagnoletti, 2013, p. 151). While utopia is the effort to bring our life into the open, in images and ideas, so that what is still hidden can be brought into the light, opening the way to a brighter future and a better world (Dolci, 1996).

2. Fostering a critical relationship with AI technologies through aesthetic experience

Although the ever-accelerating evolution of technologies puts the risks and consequences of AITs in the foreground, it is thanks to the human-technology relationship that human beings originally cultivated an extraordinary process of humanization of themselves and the natural world. They cultivated this process thanks to the invention and use of technology that was useful to render human existence more functional, manageable, comfortable. They cultivated this process also thanks to a technology not only useful but significant for expanding and broadening human feeling and intimate expression.

In both these senses (useful or significant), the use of technology started and led towards a progressive humanization of human beings.

This critical relationship between human beings and technology is now more necessary than ever. A relationship that must take account of the problematic aspects that it presents today, but also and above all of its humanizing possibilities. This critical relationship is not instinctive and cannot happen by chance. On the contrary, it must be initiated and cultivated in an early way (starting from primary school), through the formation of the capacity for thought and discernment (Malavasi, 2019; Panciroli, Rivoltella, Gabbrielli, Zawacki Richter, 2020). The human being is in fact called from the beginning to form him/herself specifically with respect to the capacity of discernment necessary to contain the possible consequences of the use of AITs and to again seize the opportunity through technology to humanize him/herself and the natural world.

It is a formation that accompanies the new generations early on and in an extensive, universal way from primary school, to cultivate those particular human qualities - critical thinking and judgment (Arendt, 1978; Ricœur, 1995, 2001; Nosari, Guarcello, 2022; OECD, 2019; Schleicher, 2020) - necessary for reflective, critical and ethical guidance and orientation of new artificial intelligence technologies (AITs), so that they remain at the service of the flourishing of the human.

This early training - currently the subject of research within the C-AIRε (Child-AI Relationship) project- can find in aesthetic experiences, especially related to visual and pictorial arts, a particularly promising opportunity (Montani, 2022; 2020, 2014). It is in the recent UNESCO document "Reimagining our futures together. A new social contract for education" that «education in the arts – music, drama, dance, design, visual arts, literature, poetry and more» is recognized, more than anything else, as significant experience for «building imagination» and «judgment» (p. 73). In fact,

«the arts also make visible certain truths that are sometimes obscured and provide concrete ways to celebrate multiple perspectives and interpretations of the world. Many forms of artistic expression traffic in subtleties and grapple with life's ambiguities; students can learn that small differences can have large effects. Artistic experience often requires a willingness to surrender to the unknown; students can learn that everything changes with circumstance and opportunity. The arts also help us learn to say, show, and feel what needs to be said, shown, and felt, helping to advance the horizons of knowing, being, and communicating in and beyond the arts. Curricula that invite creative expression through the arts have tremendous future-shaping potential. Art-making provides new languages and means through which to make sense of the world, engage in cultural critique, and take political action. Curricula can also cultivate critical appreciation and

engagement with cultural heritage and the powerful symbols, repertoires, and references of our collective identities» (p. 73).

As attested by an ancient and authoritative philosophical-pedagogical tradition, aesthetic experiences allow us to reconstruct a vision of the issues under examination that has at least three formative qualities: this is an integral, a critical and an ethical vision.

It is particularly in the wake of Deweyan thought and the work "Art as experience" (1934) that it is possible to find the foundation and definition of the first formative quality of aesthetic experience, the quality of wholeness. John Dewey, in fact, says that on the one hand, human beings usually excel «in complexity and minuteness of differentiations» (1980, p. 23) that they are able to operate with respect to their experience and thoughts. Differentiations in «compartments» (p. 20) (high and low) in values («profane and spiritual, as material and ideal», p. 20), in knowledge (religious, moral, political, economic) (p. 20), in activities (practical or intellectual, imaginative or active, finalistic or instrumental, emotionally connotated or reflective).

On the other hand, this refined capacity for differentiation does not exhaust the forms of human understanding, nor does it represent its highest and fullest expression. It is precisely «the existence of art», the American philosopher writes, to "prove" and to "test" the extraordinary human capacity that couples with the differentiation, that integrates it, that expands it: the ability to recompose the details and fragments recognized by differentiation within a whole, integral vision. In fact, art is «the concrete proof», says Dewey,

«man uses the materials and energies of nature with intent to expand his own life, and that he does so in accord with the structure of his organism – brain, sense-organs, and muscular system. Art is the living and concrete proof that man is capable of restoring consciously, and thus on the plan of meaning, the union of sense, need, impulse and action characteristic of the live creature. The intervention of consciousness adds regulation, power of selection, and redisposition. Thus it varies the arts in ways without end. But its intervention also leads in time to the *idea* of art as a conscious idea – the greatest intellectual achievement in the history of humanity» (p. 25).

This conscious restatement that - through art – the human being experiences through sense-need-instinct-action, is not the only capacity that art awakens and tests. It is, in particular, thanks to the lesson which Giovanni Maria Bertin reconstructs in "The Aesthetic Ideal" (1974) that it is possible to find the foundation and definition of the second formative quality of the aesthetic experience: the critical quality. The «aesthetic motif» (Fabbri, 2020, p. 78, our translation) leads in fact, in Bertin's words, to «enhancing» also

«the moment of the constitutive problematicity of the human as a guarantee of the "possibility" of improving, if not radically transforming, the current type of man, making him first of all more "demanding" in view of what he is and what he can be: For example, by inducing him [...] to fight, in his individuality and in the sociality of which he is a part, the forces that tend to "trivialize him" [...], that is, to flatten him, to reduce him, to standardize him» (Bertin, 1974, pp. 225-226, our translation).

The aesthetic motive therefore allows us to cultivate and to exercise a strictly problematizing competence of discernment and critical deliberation - therefore of judgment. A competence that allows the human being to recognize in reality and in his/her own existence their problema-

tic "rejects" and their transformative or even revolutionary powers (Bertin, Contini, 2004; Contini, 2009).

Finally, thanks to the Arendtian perspective and in particular to her reconstruction in "The crisis in culture: its social and its political significance" (1961) it is possible to find the foundation and definition of the third formative quality of aesthetic experience: the ethical quality. The beauty that the aesthetic experience allows us to meet, grasp and illuminate makes us in turn experience the search for the "just" (*kalòs kai agathòs*) criterion of the attestation of beauty itself. An experience that is the common search for the canon of evaluation that allows an intersubjective attestation of beauty. An intersubjective attestation that - though irreducibly intimate and personal - is sustained, rethought and confirmed with the eye of the disinterested observer. What appears (beautiful) is in fact "seen" and affirmed - Arendt explains - leaving it just as it appears, then «establish[ing] a certain distance between ourselves and the object» (2006, p. 207).

Finally, the «beauty», as «proper criterion by which to judge» (Arendt 1991, p. 271), allows - Sante Maletta specifies with reference to the Essay "The crisis in culture" - to place oneself in a critical relationship with reality and its phenomena, not in function of their usefulness but on the basis of their human value, of their being done well and for the good. «It is a peculiar human characteristic», says Maletta,

«consider all things not only for their value of use, but also for their beauty, and all actions not only for their functionality with respect to an aim, but also for their execution. It is no coincidence that Arendt stigmatizes philistinism (the use of culture as an instrument of social and individual refinement) and the instrumental conception of action as indicators of the decline of civilization. Beauty, in short, is the most significant form of manifestation of being because it acquires the possibility of being sung, glorified, immortalized, loved» (Maletta, 2009, pp. 37-38, our translation).

3. AI generated visual arts: a way of educating children to a critical relationship with AI technologies

Aesthetic experiences, in particular referring to the visual and pictorial arts, represent a very promising opportunity to reconstruct a vision of the issues under examination - therefore also of the relationship with the AITs - that is integral, critical and ethical. They can always represent a promising opportunity. At the same time, when centered on the focus of the relationship with radical technologies, their significance and effectiveness can be particularly relevant in the case of a specific subset of experiences. These are the experiences of visual arts generated with AI.

The multiplicity of experiences of AI generated digital art, accessible to new generations both in the sense of visualization and in the sense of direct use - even if as Bruce Sterling[1] notes you only count those from 2022 onwards – is impressive. To cite but a few we have of Polynomiography (Kalantari, 2009) which generates aesthetic patterns through the approximation of solutions of algebraic equations (Gdawiec, 2017); Google DeepDream that generates "dreamlike"

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[1] www.biennaletecnologia.it/sessioni/la-nuova-arte-dellintelligenza-artificiale (07.04.2023)

images through a code that can identify in any image (faces, animals, ...) some patterns, to make them emerge and make them visible to the human eye, replicating them endlessly[2]; DALL-E, Imagen and Midjourney software that generate new images from textual compositions[3]; and Maze Generator that generates mazes through artificial intelligence[4].

Within this wider panorama, Painting Fool is particularly interesting, an "artificial artist" created in 2001 by Simon Colton (2012), computer scientist of the Research Group Game AI and professor of "Computational Creativity" at Queen Mary University in London and at the Sensilab of Monash University in Australia. Painting Fool is able to generate completely new objects that do not exist in reality and to translate facial expressions (detected with facial recognition software) into emotions portrayed on the canvas modulating colors, stroke intensity etc. For example, on the basis of a photograph of a face that expresses disgust, Painting Fool uses colors and techniques that repaint the facial features in order to make them more expressive of the emotional effect[5].

The experiences of AI generated digital art, more often used for recreational, expressive and artistic purposes in the informal or professional field (Alexenberg, 2008; Song, 2020), are not totally unrelated to a use for formative purposes. In fact, especially in the last decade, they have started to become present in the school landscape, although mostly confined within specific disciplinary areas. Areas particularly related to scientific areas and STEM/STEAM (Monteith, Noyce, Zhang, 2022) or to technical-artistic disciplines (Jing Li, Bingyu Zhang, 2022; Qian, 2021) mainly placed at the secondary school level. Examples of AI generated digital art used for educational purposes include polynomiography (Kalantari, 2004) for teaching mathematics and geometry (Russo, 2011) or digital labyrinths for exercising logical-deductive skills (Franco, 2023).

At the primary school level, the experiences of AI generated digital art used for educational purposes are rarer. Where they exist, they are conducted, for example, with the support of smart glasses for augmented reality, pix2pix for image-to-image transformation, opencv for real-time machine vision, BBC micro bits for the coding necessary for the creation of games and digital activities, Blocky for the creation of visual programming languages (Chen, Lin, Chien, 2022; Lu, Lo, Syu, 2022). In primary school these experiences, always conceived with technical-artistic disciplinary purposes, have demonstrated their effectiveness in improving students' performance in painting, color recognition, imagination (expressiveness, originality, and richness) (Chen, Lin, Chien, 2022), STEAM abilities (Li, Luo, Zhao, Zhu, Ma, Liao, 2022), and also in problem-solving skills, innovation, creativity and cooperation (Lu, Lo, Syu, 2022).

Still absent however, is the staging of AI generated digital art experiences, intentionally aimed at exercising children at a critical and creative meeting with the AITs. A meeting that does not want

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[2]

      www.deepdreamgenerator.com (07.04.2023)

[3]

      www.openai.com/product/dall-e-2; www.imagenarts.com; www.midjourney.com (07.04.2023)

[4]

      www.mazegenerator.net (07.04.2023)

[5]

      www.newscientist.com/gallery/painting-fool; www.artelectronicmedia.com/en/artwork/the-painting-fool/ (07.04.2023)

to teach about a specific field of knowledge or the technical functioning of a software (Previtali, 2021), but rather to stage a problematizing experience with regard to potentialities such as criticalities of AITs and of their use by the human being.

To make a problematizing experience of the power of a technology that, as from its origins, can even today be conceived, designed and used - also thinking of the professional futures of current primary school children - to generate new possibilities of humanization of existence. A humanization that started thanks to those same "artistic" techniques - techniques of "exteriorization of the hand", as André Leroi-Gourhan (2018) would say - that, since the time of the Lascaux caves (Bataille, 2007) have accompanied human beings for millennia towards an extraordinary experience of life expansion in the human sense.

Alongside the experience of potential, the meeting with the AITs - precisely because it is a meeting as creative as it is critical - wants at the same time to be an early reflective experience on the risks and dangers of an artificial technology used without any rational and ethical discernment. Risks and dangerousness, to be recognized and defined to the extent of the moral abilities (Nucci, Narvaez, 2014) and the interests of primary school children, who find, in the studies and research of Manuelle Freire (2014), interesting formative suggestions.

Freire in fact recognizes at least four critical areas in the relationship with AITs (in particular related to digital art), which should be problematized at school for their - at the same time - potential and criticality: the question of cooperation in digital creation, the question of remixes and mashups of existing products, the question of illusions and false knowledge about the "power" of artificial intelligence; the issue of the social potential of digital art that on the web can reach very high numbers of people.

Some suggestions that invite problematization:
   • the concept of creativity: what is creativity, what can be defined as creative, who is the creative agent between the human being and technology, what is the role of others/ community in the creative process, ... ;

   • the concept of artificial: what is intelligence, in what sense can it be defined as artificial, in what aspects do human and artificial intelligence differ, who generates artificial intelligence, ...;

   • the concept of beauty: what is beauty, is it possible to program an artificial system to produce beauty, or define the level of beauty of a specific aesthetic performance, ... ;

   • the concept of cloning: what are the meanings of imitation, copying and reproduction, what are the functions and purposes of a copy and copying, what are the connections between imitation, copying, reproducing and copyrights.

4. Child - AI Technologies Relationship (C-AIRε). The international research project

On the basis of this theoretical framework, the "C-AIRε" research project - funded and led by the University of Turin in partnership with Middlesex University, London, and the West University of Timişoara - has conceived an innovative training practice targeted at primary school children

and realized through aesthetic experiences conducted with AI generated visual arts (Artivive Platform).

The project aims to answer to three research questions:

- How to help children in primary school to develop a critical and creative relationship with AITs through aesthetic experiences of visual art generated with AI?

- What specific educational outcomes can be achieved through these experiences?

- How to involve families and community in this formative process?

Consequently, the objectives of the research project are to understand whether, how and under what circumstances aesthetic experiences of visual art generated with AI can train children in a critical and creative relationship with AITs.

The research methodology refers to the art-based participatory action-research (Crobe, 2020; Huckaby, 2018; Leavy, 2017; Prior, Kossak & Fisher; 2022; Rubesin, 2018; Wang, Siegesmund & Hannes, 2017). It is a particularly fertile research methodology in the field of scholastic education especially because of its capacity to actively involve teachers and children and to promote critical and creative processes of human experience understanding and social contexts transformation. Processes activated and nourished precisely thanks to art-based experiences.

Within this methodological perspective, the research involves four primary schools (one in Timişoara, two in Turin and one in London), eight teachers, six classrooms, children's families and communities.

The research planning follows three progressive phases. In the first phase (from March to April 2023) a formative path with the involved teachers is realised in order:

- to share and reflect on the issue of the development of a critical and creative relationship with AITs, through aesthetic experiences of visual art generated with AI;

- to design the aesthetic experience to be undertaken with children, through the use of the "Artivive" augmented reality platform for art.

In the second phase (in May 2023), the formative experience with children (9-11 years old) is experimented on the theme "Inner Faces: between Human and Artificial". The experience follows the next formative steps:

- each child reflects on the image of his/her inner face;

- he/she paints the skin of his/her inner face (a landscape, an animal, vegetable, …) and takes a photo of it;

- he/she inserts this photo (the skin) into Artivive program for giving it soul and life through new elements (the elements of face) and creates and augmented image of his/her face;

- presentation and reflection on each face;

- plenary discussion on the creative and expressive potentialities of AITs and on some problematic aspects (artificial creativity and intelligence, cloning, beauty).

In the third phase (in November 2023), the international virtual exhibition is presented, in which to share the children's artworks alongside those of professional artists. This opportunity facilitates the sharing with parents and communities of the children's core reflections on their relationship with AITs and highlights some of the most critical points guiding the relationship that new generations have with the AITs.

Among the main expected outcomes, the research aims to identify:

- specific formative outcomes achieved by children;

- steps, methodology and evaluation of a first pilot formative "model" in primary school to develop a critical and creative relationship with the AITs through aesthetic experiences of visual art generated with AI.

In order to evaluate these outcomes, researchers and teachers intend to analyse and interpret (Efrat Efron & Ravid, 2019):

- the pre and post qualitative questionnaires filled out by children on the topic of the relationship with AITs (criticalities and potentialities);

- the questionnaires filled out by children on the realised formative experience;

- the dialogues (among children-teachers-researchers) recorded during the activities in the classroom;

- the artworks created by the children;

- the individual semi-structured interviews with the participating teachers after the completion of the formative experience.

The implementation and evaluation of the three research phases do not represent the conclusion of the project. Based on the results obtained and the training process implemented, the future research perspectives are divided into two levels: a first level of involvement of primary schools on a larger scale in carrying out the training course and a second level of diversification and deepening of the aesthetic experience with artificial intelligence.
As regards the first future development plan, the intention is to create a final virtual exhibition of the third phase of research in the form of an educational exhibition also aimed at being used by new primary school classes (second cycle) during the 2023 school year -2024. Through the use of the IWB, children and teachers will in fact be able to both enjoy the artistic content and learn methods and processes for creating the same products by reproducing/adapting the training activity experienced in the pilot classes. The virtual exhibition will in fact provide a virtual guide and video tutorials functional to understanding the meaning of the content and the methods of implementing the training process in the classroom.
As regards the second future development plan, the intention is to set up an immersive Augmented Reality experience within a specially created work in order to promote a process of critical reflection on the relationship between human beings and artificial intelligence technologies (Montani, 2014). The immersive experience, planned to create a Deweyan educational envi-

ronment (Dewey, 2014), will be aimed at primary school classes (second cycle) who have previously joined the classroom training course.

Conclusion

The only challenge that the new generations with certainty - as far as we can imagine today - will meet when they become adults concerns cohabitation with artificial intelligence technologies. This makes technologies not only a professional or specialist tool but an "extension" of the human being that pervades his daily life in all fields of his existence (economy, health, industry, culture, domotics ...). An extension that the human being is called to know how to critically manage and - even more daringly - to know how to conceive in view and at the service of promoting an existence of human quality.

The existence of this challenge in turn challenges the only agency that has the institutional task of training children in an early and universal way: primary school. Primary schools are therefore called to rethink their curricula with a view to planning and implementing a systematic encounter between children and artificial intelligence technologies. A meeting that works on a critical level and in a transdisciplinary way to initiate and incisively cultivate a problematic and ethical approach with technologies.

Author contribution statement
E.G. and A.L. conceived of the idea here. E.G. developed sections 1, 3, 4 and 5. A.L developed section 2. All authors discussed the text and revised the final article.

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