EDUCATIONAL SUSTAINABILITY: MOXIE AND TEACHING FROM A LIFELONG LEARNING PERSPECTIVE

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ABSTRACT
The UN 2030 Agenda aims at sustainable educational development thanks to the promotion of a holistic approach in a bio-psycho-social key favored by the integrated use of technologies at school. Considering recent works on the relationship between AI and education (Sancassani, 2023), schools must promote emotional and relational skills in the perspective of lifelong learning (Rivoltella, Rossi, 2019). In line with EU indications, the integration of digital educational technologies and AI (Elias et al., 1997) could structure essential competences for active citizenship and for the promotion of social and emotional learning (Agenda 2030). An example of this is the embodied Ai Moxie (Deng et al, 2019). At school, literacy related to embodied Ai Moxie could prove to be particularly effective in the Italian education system to aim at the diffusion of digital culture oriented towards educational sustainability (Malvasi, 2023).

L'Agenda 2030 dell'ONU mira allo sviluppo educativo sostenibile grazie alla promozione di un approccio olistico in chiave bio-psico-sociale favorito dall'uso integrato delle tecnologie a scuola. Alla luce dei recenti lavori sul rapporto tra AI ed educazione (Sancassani, 2023), la scuola deve promuovere le competenze emotive e relazionali nella prospettiva dell'apprendimento permanente (Rivoltella, Rossi, 2019). In linea con le indicazioni dell'UE, l'integrazione delle tecnologie educative digitali e dell'IA (Elias et al., 1997) potrebbe strutturare competenze essenziali per la cittadinanza attiva e per la promozione dell'apprendimento sociale ed emotivo (Agenda 2030). Un esempio di ciò è l'incarnazione di Ai Moxie (Deng et al, 2019). A scuola, l'alfabetizzazione legata all'embodied Ai Moxie potrebbe rivelarsi particolarmente efficace nel sistema educativo italiano per puntare alla diffusione di una cultura digitale orientata alla sostenibilità educativa (Malvasi, 2023).

KEYWORDS
Agenda2030, Soft skills, VOCA, Embodied AI, Moxie
Agenda2030, Competenze trasversali, VOCA, Embodied AI, Moxie

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Introduction[1]

Emotional intelligence and relational skills are fundamental elements for the holistic development of the human being (UN 2030 Agenda). These elements represent the pillars for the full realization of active citizenship which is necessarily linked to effective social-emotional learning (SEL) (Elias et al., 1997). In line with the European guidelines on key competences for lifelong learning (Recommendation of 22 May 2018), the integration of soft skills and new technological frontiers in educational contexts aims to develop the essential skills to structure critical thinking in an increasingly digital and interconnected world (Rivoltella and Rossi, 2019; Sancassani, 2023).

1. Soft Skills and AI

The Council of Europe Recommendation outlines eight types of key competences:

- Functional Literacy Proficiency
- Multilingual proficiency
- Mathematical competence and competence in science, technology and engineering
- Digital Competence
- personal, social competence and the ability to learn how to learn
- Competence in matters of citizenship
- Entrepreneurial competence
- Competence in cultural awareness and expression

In order to integrate soft skills and relational competences into European education systems, it is necessary to reprogram teaching in a bio-psycho-social perspective capable of communicating with the new opportunities offered by technological progress. In this context, the research on the integration between AI and education presents numerous testimonies that indicate how soft skills and relational competences are developed more with the use of embodied AI both compared to traditional teaching and compared to the same artificial intelligence in a non-embodied version (Komatsu 2010; Shahid et al., 2014).

[1] This paper is the result of the shared work of the authors; however, for the purposes of the attributions of its individual parts, it is divided as follows: Simona Iannaccone §§ 2 The situation in Italy; Marta Raffone §§ 3 The AHP method; Antinea Ambretti: § 1 Soft Skills and AI and Conclusions

Figures 1PaPeRo Ai virtual agent (left) PaPero Embodied agent (right)

Embodied AI can either have a virtual body or a physical body such as a robot, but only physically embodied agents have the unique opportunity to share the environment with their user. The physically embodied agent, through the multimodal receptors connected to it, can interact with the external environment and its users in ways that a virtual agent cannot clearly reach. Through a meta-review of 65 articles comparing 87 embodied and non-embodied agents, it is clear that in 93.8% of the studies the embodied agent is at least able to equal a non-embodied agent in efficiency, while in 78.5% 89 of the studies the embodied agent exceeds the performance of the non-embodied agent (Deng et al., 2019).

In the context of the development of emotional literacy, soft skills and relational competences, the embodied Ai Moxie opens up surprising perspectives.

Numerous studies in the field of child development have shown that the intersection of artificial intelligence and education can lead to innovative solutions. Moxie, a socially assistive robot developed by Embodied Inc. in collaboration with the Global Robotics Laboratory (GRL), represents a novel approach to supporting individuals with specific developmental disorders. Going beyond traditional interventions, Moxie provides a personalized and engaging platform for children ages 5 to 10.

The trial of Moxie Ai at the Help Group School in Los Angeles was based on **pre-, intra- and post-intervention subjective assessments**, through standard tests for parents and therapists, including the Social Responsiveness Scale (SRS) for the severity of social symptoms and the Social Skill Improvement System Rating Scale (SSIS) for a comprehensive assessment of social skills. The Moxie robot collected **objectively measurable data** through the analysis of facial expressions, eye contact, number of smiles, and automatic speech recognition. Subjects confirmed significant improvements in emotion regulation, self-esteem, conversational ability, and ability to make friends. Objective assessments of Moxie recorded equally significant improvements in attention and engagement time, eye contact, shift balance, conversational smiles, and relational speech after just six weeks of intervention (Hurst, N., Clabaugh, C., Baynes, R., Cohn, J., Mitroff, D., Scherer, S., 2020).

Moxie's target is very specific but, net of the proposed activities and the uniqueness represented by an objective measurement of data, it is clear that not only is a systemic and organized approach to the development of soft skills and relational skills possible in traditional learning systems thanks to AI, but that their use makes the process of internalization of these elements more efficient.

Fig. 2 Moxie Ai

2. The situation in Italy

Law 2782/2022 launches a first national experiment, on a voluntary basis, lasting 3 years, for children in study cycles between 6 and 16 years old. The project does not include additional school hours but a revision of teaching methods to develop methodologies based on emotional intelligence.

To underline the urgency of developing emotional and relational skills, the results of the Istituto Superiore di Sanità on peer relationships, school context, bullying and cyberbullying in the Italian population between 6 and 16 years old in the years from 2019 to 2022 are reported. The results of the HBSC 2022 data collection were presented at the Istituto Superiore di Sanità (ISS) on 8 February 2023 at the national conference "Adolescent health: data from the Health Behaviour in School-aged Children - HBSC Italia 2022 surveillance". The survey involved a representative sample of young people aged 11, 13, 15 and, for the first time this year, 17-year-olds in all regions. For a total of over 89,000 boys and girls, more than 6,000 classes and more than 1800 schools.

Approximately 75% of children feel accepted by their teachers but only half trust them very much (55%) and perceive a real interest in them from teachers (49%), with a decreasing trend as age increases. On the other hand, about half of 11-year-olds feel very stressed by school commitments to grow to 60% and 78% respectively in 15-year-old boys and girls.

In the most critical relational behaviours, on the other hand, bullying seems to maintain its peculiarities without major variations. Its occurrence is around 15% overall and decreases with increasing age, with proportions of 19% among 11-year-olds, 16% in 13-year-olds and just over 9% among 15-year-olds. Similar proportions are observed for cyberbullying, which is more frequent in girls (17% vs. 13%) and in younger ages: 19% at 11 years of age, 16% at thirteen years of age and 10% at 15 years of age.

As far as new technologies are concerned, particular attention should be paid to young people who use social media problematically: 16.9% of girls and 10.3% of boys. Among 15-year-old girls, the prevalence is over 20%.

Compared to the 2017/2018 data, an increase in this use can be observed, especially among girls, for which the prevalence increases by 5% (from 11.8% to 16.9%, compared to boys who go from 7.8% to 10.3%). 17-year-old boys and girls were involved for the first time in the HBSC 2022 survey as the Prime Ministerial Decree of May 2017 extended surveillance on adolescents to this age group as well, which, in terms of relational and cognitive skills as well as differences related to body development, differs significantly from 11, 13 and 15-year-old boys. For this reason, the description of their characteristics and lifestyles has been deliberately treated separately.

Excess weight at this age is 19.3% (15.9% overweight and 3.9% obesity) and is significantly higher in males (overweight and obese males: 19.8% and 3.9% vs females: 11.7% and 2.8%).

Daily physical activity is significantly higher among males (7.1% vs 3%); On the other hand, girls at this age spend more time in front of screens.

About one in three boys and two in five girls said they had smoked at least one day in the past 30 days. Alcohol consumption at least once in the last 30 days (7 out of 10 boys) has less marked gender differences.

83% of girls and 78% of boys say they have never smoked cannabis in the last 30 days.

The perception of one's health status as "excellent/good" is higher among males (86.7%) than among females (72.6%).

39.3% have gambled at least once in their lives with marked gender differences (males 57.6% vs females 20.2%).

From the data analysed, specific areas in which young Italians need support are identified, such as bullying, cyberbullying, problematic use of social media and mental health, allowing a targeted allocation of resources. Below, a SWOT analysis is presented that underlines the urgency of an effective integration of AI to support the development of soft skills and relational competences in the Italian education system.

Strengths

1. **Better learning experience**: The integration of social assistive AI can provide learning experiences that are tailored to students' learning needs and styles.
2. **Improving soft skills development**: Social assistive AI can complement traditional education by offering interactive exercises and providing feedback, promoting the development of communication, collaboration, critical thinking, and creativity.
3. **Accessibility**: AI-powered platforms can make education more accessible to students with diverse learning abilities by offering tailored support and adjustments.

4. **Teacher support**: AI tools can help teachers by automating administrative tasks, providing data-driven insights into student performance, and offering suggestions for personalized interventions.

Weaknesses:

1. **Dependence on technology:** Over-reliance on assistive social AI can reduce human interaction in the classroom, hindering, paradoxically, the development of interpersonal skills that are attempted to be solicited
2. **Equity issues**: uneven access to AI technology between schools and regions, the so-called *digital divide*, existing disparities in educational opportunities.
3. **Privacy concerns**: The integration of AI into education raises privacy concerns regarding the collection, storage, and use of data, particularly with sensitive information of underage students.
4. **Training needs**: Educators may need training and support to effectively integrate AI tools into their teaching practices, which may pose challenges in terms of time, resources, and willingness to adapt.

Opportunity:

1. **Innovation in education**: the integration of social assistive AI represents an opportunity to innovate and modernize the Italian education system, preparing students for the needs of the digital age.
2. **Personalized learning**: AI-powered adaptive learning platforms can provide personalized instruction tailored to each student's strengths, weaknesses, and interests.
3. **Global collaboration**: Collaboration with AI developers, educational researchers, and policymakers from other countries can facilitate the exchange of knowledge and the sharing of best practices.

4. **Career readiness**: Equipping students with soft skills and familiarity with AI technologies can enhance their preparation for future careers in various fields.

Threats:

5. **Resistance to change**: Resistance from educators, parents, policymakers, and other stakeholders can impede the adoption of assistive social AI in the education system.
6. **Ethical considerations**: Ethical dilemmas related to AI, such as bias, transparency, and accountability, must be addressed to ensure responsible use in education.
7. **Job shift**: Concerns may arise about AI replacing human jobs, including teaching roles, leading to opposition and scepticism.
8. **Digital divide**: Socioeconomic disparities in access to technology and digital literacy could widen the gap between privileged and marginalized students, perpetuating inequality.

3. The AHP method

In addition to the difficulties related to access to IT infrastructures and the consequent digital divide, significant problems arise both in the re-elaboration of teaching activities in a PBL key according to the development of soft skills, and for their evaluation which, due to the VUCA (*Volatility, Uncertainty, Complexity, Ambiguity*) nature of the same, require different evaluation models (De Santis, C., Morelli, G., 2019).
In order to be able to effectively evaluate VUCA variables, it is necessary to divide the soft skill to be analysed into individual elements that contribute to the realization of the assessment.

The Analytic Hierarchy Process (AHP) is a method of organizing and analysing complex decisions. It consists of three parts: the ultimate goal or problem to be solved, all possible solutions, called alternatives, and the criteria by which the alternatives will be judged. The AHP provides a rational framework for a necessary decision, quantifying its criteria and options and correlating these elements to the intended objective.

The importance of criteria is compared through the relationship between pairs of elements.

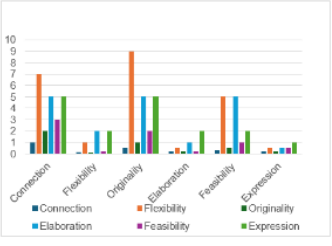
1. Establish criteria and alternatives:
    - Criteria: connection, flexibility, originality, elaboration, feasibility
    - Rating: Not satisfied, Satisfied, very satisfied, Excellent
2. Create a pairwise comparison matrix for the criteria:
    - Compare each criterion with every other criterion and assign a relative importance score based on their contribution to the soft skill you have chosen to evaluate.
    - The scale for comparison could be from 1 to 9, where:
        - 1 The two criteria are equally important
        - 3 One is slightly more important than the other
        - 5 One is significantly more important than the other
        - 7 One Is Much More Important Than the Other
        - 9 One is far more important than the other
        - 2, 4, 6, 8 are used for the values between these judgments
4. Calculate the weight for each criterion
5. Normalize the pairwise comparison matrix to get the relative weights of each criterion.
6. Create a pairwise comparison matrix for the alternatives in each policy
7. Compare each alternative with each alternative based on each criterion and assign a score
8. Calculate the weight for each alternative based on each criterion
9. Normalize the pairwise comparison matrix for each criterion to get the relative weights of each alternative.

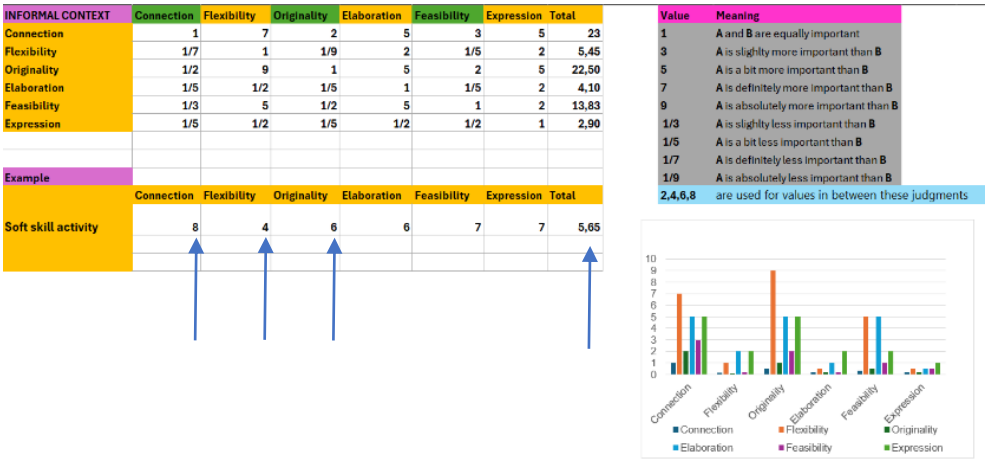
Students, using the AHP system, carry out a self-assessment of their performance. This step is fundamental for the knowledge of metacognitive dynamics and for the development of skills such as personal, social and the ability to learn to learn.

INFORMAL CONTEXT	Connection	Flexibility	Originality	Elaboration	Feasibility	Expression	Total
Connection	1	7	2	5	3	5	23
Flexibility	1/7	1	1/9	2	1/5	2	5,45
Originality	1/2	9	1	5	2	5	22,50
Elaboration	1/5	1/2	1/5	1	1/5	2	4,10
Feasibility	1/3	5	1/2	5	1	2	13,83
Expression	1/5	1/2	1/5	1/2	1/2	1	2,90

Example	Connection	Flexibility	Originality	Elaboration	Feasibility	Expression	Total
Soft skill activity	7	6	9	6	7	7	7,04

Value	Meaning
1	A and B are equally important
3	A is slighlty more important than B
5	A is a bit more important than B
7	A is definitely more important than B
9	A is absolutely more important than B
1/3	A is slighlty less important than B
1/5	A is a bit less important than B
1/7	A is definitely less important than B
1/9	A is absolutely less important than B
2,4,6,8	are used for values in between these judgments





INFORMAL CONTEXT	Connection	Flexibility	Originality	Elaboration	Feasibility	Expression	Total
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Originality	1/2	9	1	5	2	5	22,50
Elaboration	1/5	1/2	1/5	1	1/5	2	4,10
Feasibility	1/3	5	1/2	5	1	2	13,83
Expression	1/5	1/2	1/5	1/2	1/2	1	2,90

Example	Connection	Flexibility	Originality	Elaboration	Feasibility	Expression	Total
Soft skill activity	8	4	6	6	7	7	5,65

Value	Meaning
1	A and B are equally important
3	A is slighty more important than B
5	A is a bit more important than B
7	A is definitely more important than B
9	A is absolutely more important than B
1/3	A is slighty less important than B
1/5	A is a bit less important than B
1/7	A is definitely less important than B
1/9	A is absolutely less important than B
2,4,6,8	are used for values in between these judgments

Figures 3 AHP comparison examples

Teachers and trainers, using the same AHP matrices, carry out the final evaluation and compare it with the students' self-evaluations. Evaluation acquires an educational, projective, student-centred character and is characterized as authentic, since it looks at the processes activated and not only at the performance achieved.

Conclusions

In Italy, we are far from both an effective integration of soft skills and relational competences in the education system and the use of new technologies for education.

The comparative analysis of the projects presented highlights the urgency of the development of emotional skills in the Italian education system both for the sustainability of education and for the promotion of relational skills.

The research identifies several challenges and areas for improvement. These include the need for regular and continuous programming related to teacher training in a lifelong learning perspective, equal access to digital resources, and ongoing support for the implementation of emotional learning initiatives in educational programs.

Looking to the future, it is crucial that policymakers, educators, and stakeholders work together to foster a culture of emotional intelligence and lifelong learning that ensures the continued development and prosperity of society.

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