Teaching AI with Humanity: Breaking Barriers. A Journey into Ethical and Inclusive Artificial Intelligence through Hands-On, Student-Centered Learning.

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Abstract
This study presents a curriculum-driven exploration of Artificial Intelligence (AI) with lower secondary school students (ages 11–13) that integrates machine-learning (ML) and block-based coding to cultivate both AI literacy and inclusive learning practices. The activities were focused on either facial emotion recognition, aiming to create a virtual assistant capable of recognizing and classifying human facial emotions, or AI-assisted communication and voice-controlled interfaces to program a wheelchair mounted sprite controlled by simple voice commands to simulate assistive robotics. The program supports the Sustainable Development Goals (SDGs), particularly quality education and reduced inequalities. By integrating supervised machine learning, block-based programming, and inclusive design, the initiative empowered students to understand, criticize, and apply AI with ethical sensitivity, and practical relevance.

Keywords: Artificial Intelligence, Lower School Education, Machine Learning, Inclusive Technology, SDGs, Ethical AI, Visual Programming

1. Introduction

As Artificial Intelligence becomes an increasingly pervasive presence in everyday life, the urgency to equip young learners with tools to navigate, understand, and critically engage with AI systems has grown. Simultaneously, inclusive education calls for strategies that support students with special needs—particularly those with relational, language, or motor disabilities. This project reflects that vision by engaging students aged 11–13 in authentic learning experiences that combine AI literacy, technological creativity, and social responsibility, with a strong focus on ethical understanding, human dignity, and real-world application. The initiative supports global goals, including the UN Agenda 2030's SDG 4 (Quality Education) and SDG 10 (Reduced Inequalities), fostering inclusive, forward-looking pedagogies. Students from different socio-economic backgrounds were invited to design AI-powered solutions inspired by community needs, thereby anchoring technological exploration in empathy and imagination.

This paper describes the outcome of classroom experiences, designed to address both imperatives by leveraging accessible, block-based AI tools. We frame our work within the "Results for AI in Education Research" track of the MIT AI & Education Summit 2025, emphasizing practice-based evidence of how AI activities can foster both digital literacy and inclusion.

2. Related Work

Prior studies have demonstrated the value of block-based environments (e.g. Scratch, Pictoblox) for introducing computational thinking and simple machine-learning concepts to adolescents [1,2,3]. Research into AI-driven emotional recognition has highlighted its potential for socio-emotional learning, yet its classroom application remains not fully explored [4]. Moreover, voice-controlled robotics and AAC systems have been shown to support learner autonomy and inclusion, but integration with AI education is emergent [5]. Our work bridges these threads by embedding ML-powered emotion recognition and voice command control within an inclusive pedagogical design.

3. Methodology

The study was realized at Istituto Comprensivo Anchise Picchi in Collesalvetti, a lower secondary school located in a rural Italian context. The participants included a heterogeneous group of 28 students aged 11–13 with different family and cultural backgrounds. The methodology followed a two-phase structure. In the **first, exploratory phase**, students engaged in guided discussions on the pervasiveness of AI in everyday life, followed by unplugged and technology-mediated activities. They used decision-tree simulations and image classification games to understand key AI principles.

Platforms like Teachable Machine by Google and ML for Kids enabled them to build custom models.

The **second phase** emphasized project-based learning using block-based programming platforms such as Scratch, Stretch3, and Pictoblox, with AI extensions. Students explored machine learning using **Teachable Machine by Google** and **ML for Kids**, which enabled the creation of personalized AI models without requiring login, thus ensuring GDPR compliance for under-14 learners. Models were then integrated into block-based code environments for application testing.

In order to develop a well-functioning program, students were guided through a structured process that began with the *creation of a dataset*, using either images or sounds depending on the project. The dataset built for image recognition was split into two different groups: a larger one with images used for the training phase, and a smaller one used to test the model. It is crucial to avoid using dataset images to verify the model, as this would prevent students from finding possible mistakes. Once trained, the model was validated using test samples to assess its accuracy and effectiveness. If necessary, students revised and improved the model based on the results of this validation phase. Finally, the trained model was imported into a visual block-based programming environment, allowing students to integrate it into interactive digital artifacts.

4. Learning Approach

Students worked in collaborative groups, employing iterative design and peer coaching strategies. Guided reflection, creative problem-solving, and structured experimentation helped them understand AI as both a technical and ethical domain. Through symbolic image detection and voice inputs, learners explored assistive technology for emotion detection and AI-mediated communication. The project promotes empathy and inclusion, particularly through the design of accessible tools—highlighting how AI can be a valuable resource for individuals with special needs.

5. Results

Two primary ML platforms were tested:

- Teachable Machine + Stretch3
- ML for Kids + ML2Scratch

Both tools offered GDPR-compliant, no-login options suitable for minors and offered intuitive interfaces. ML for Kids allowed project persistence via browser storage or temporary educator-managed accounts: this option allowed secure classroom environments with teacher-assigned nicknames, although it is free for only 15 days.

In the following pages, two examples are described:

A) <u>*Voice-controlled sprite movement*</u> (simulating wheelchair voice-controlled movement)

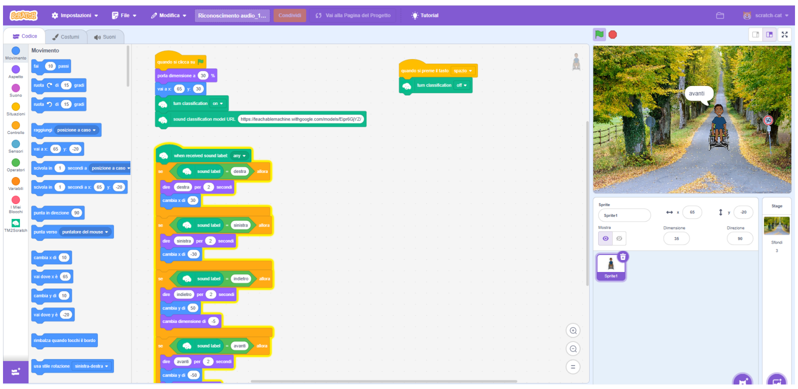
In order to carry out the activity, students were actively involved in each step of the process. They began by selecting appropriate voice commands, followed by the recording of audio samples from a single speaker. These recordings were then used to train supervised machine learning models capable of associating voice inputs with directional commands. Once the models were trained, students validated their accuracy and further refined them, also incorporating group-recorded samples to improve generalization. The refined models were subsequently integrated into programming environments, where students applied Cartesian coordinates to simulate movement and test the functionality of their voice-controlled sprite.

Initial voice models trained with a single speaker had limited generalization but high accuracy. Later iterations involving multiple students improved accuracy across different voice profiles. Taking into consideration the practical use of the model, the first attempt proved to be more effective in recognizing the tone and pitch of the wheelchair owner.

Students learned that:

- **Single-word commands** improved recognition speed and accuracy;
- **Phonetically similar words** (e.g., *"su"/"giù" meaning "up" and "down"*) reduced model reliability or needed clear pronunciation (*"destra"/"sinistra", i.e ""right"/"left")* ;
- **Well-chosen antonyms** like "avanti"/"indietro (*"forward"/"backward")* yielded higher performance.

Students successfully linked ML models to sprite movement, reinforcing mathematical concepts like coordinates (moved sprites along x/y axes). Projects were validated through classroom demonstrations and peer testing, yielding promising outcomes in user interaction and reliability.



B) <u>*Emotion Recognition*</u> (useful for people with relational difficulties)

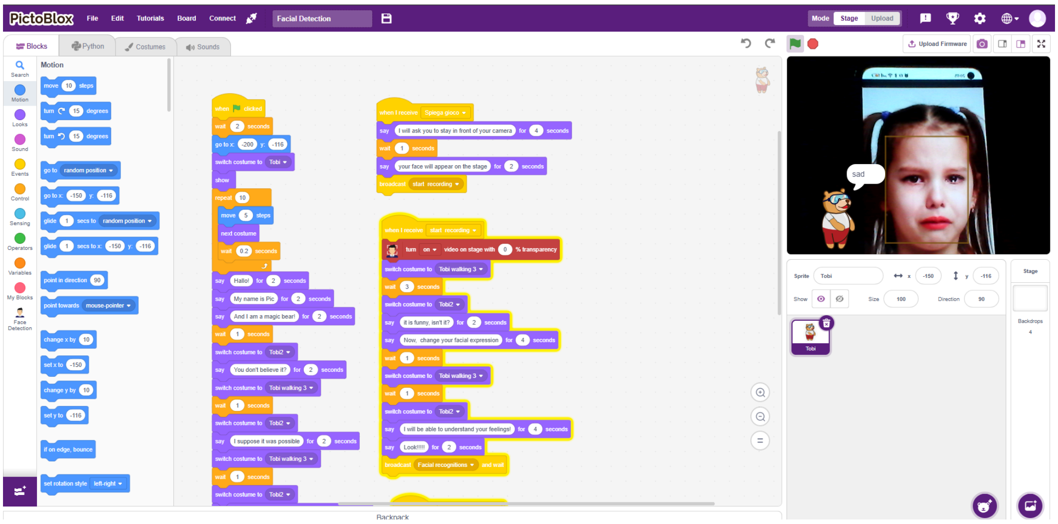
In order to carry out the activity, students selected appropriate images, including photos and drawings, which were used to create both a training and a validation set. Next, they trained supervised machine learning models to recognize emotional expressions from facial images. Once the models were developed, the students validated their accuracy and refined the training when necessary. The trained models were then integrated into block-based programming environments, enabling the students to implement the program and use it to build a narrative or create a friendly digital assistant.

Students learned that:

- **The use of different types of image** (kids, child, adolescent, adult, male and female) improved recognition and accuracy;

- **Sadness and Neutral were the most difficult emotion to distinguish;**

Students imported ML models first in Pictoblox then in Stretch3 to obtain reliable projects that were validated through classroom demonstrations and peer testing.



6. Lessons Learned

The implementation of this AI and machine learning curriculum provided several insights into what works well and what challenges may arise. One of the most effective elements was the hands-on, project-based structure, which allowed students to engage with real-world problems through accessible tools such as Teachable Machine+Stretch3 and ML for Kids + ML2Scratch. For example, designing an assistive sprite controlled by voice input was not only a technical task, but also an opportunity to reflect on inclusion and accessibility.

Another key factor was collaborative learning. Group work encouraged peer-to-peer interactions and helped students overcome technical and conceptual difficulties together. Students with diverse learning profiles also benefited from the multimodal nature of the activities—visual, auditory, and kinesthetic engagement.

However, challenges did emerge. Voice recognition models trained in noisy classrooms often produced unreliable results. Furthermore, before starting an AI mediated project, students need to be trained in order to understand what AI is and how a supervised model works. Simple activities (plugged or unplugged) may be helpful to let students gain familiarity with English terminology such as "dataset," "model training," and "bias." Technical issues, such as low-quality microphones or unstable internet connections, occasionally slowed progress. These issues underscore the importance of combining technological experimentation with critical reflection on the limitations and ethical dimensions of AI.

7. Recommendations for Replication

Educators interested in replicating this curriculum should be aware that the technical requirements are relatively minimal. A standard computer or tablet equipped with a functioning microphone and stable internet connection is generally sufficient, especially when combined with access to freely available platforms. However, to ensure effective implementation, it is essential that teachers receive some initial preparation. While in-depth technical expertise is not required, a basic understanding of visual based programming and machine learning concepts—such as supervised learning, dataset training, and algorithmic bias—proves highly beneficial. Short professional development sessions focused on these topics, especially with an emphasis on ethical implications, can significantly increase teacher confidence and classroom success.

Some challenges should be anticipated. Among the most common are a general lack of teacher familiarity with AI tools and time constraints within rigid curricular structures. Moreover, students may initially resist open-ended, trial-and-error learning approaches if they are accustomed to more traditional instructional models.

Despite these potential barriers, the curriculum remains highly adaptable. In contexts where resources are limited, simplified versions of the activities can be used—for example, by employing offline recordings. For younger learners or those with limited digital fluency, visually based tasks using image classification often offer a more accessible entry point than voice recognition and should therefore be preferred. Throughout, encouraging students to document their design process, reflect on iterations, and embrace errors as part of learning can support the development of a growth mindset and enhance the overall educational impact.

By combining hands-on technological exploration with inclusive pedagogical strategies, this curriculum offers a replicable model that supports meaningful engagement with AI and machine learning while promoting digital literacy, ethical awareness, and critical thinking—competencies that align closely with the goals of equitable and inclusive education defined by the Sustainable Development Goals.

8. Conclusion

The experience confirmed that students aged 11–13 can not only grasp AI concepts, but also design and implement functional AI systems with clear societal relevance. Results aligned with multiple **UN Sustainable Development Goals**:

- **SDG 4 – Quality Education**, by fostering digital and critical skills;
- **SDG 10 – Reduced Inequalities**, through inclusive design targeting mobility and communication challenges.

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