AI Computational and Ethical Awareness in Italian High Schools: a series of workshops*

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Abstract

The main goal of this paper is to explore and analyse the teaching methodologies and practices that guided the creation of ten workshop experiences for Italian high school students. The workshops were created within the framework of the D.M. 65/2023 and were focused on educating students on cognitive, operational, critical, and ethical aspects of AI. In particular, we wanted students to realise that AI is not smarter than them and to reduce their fear of this tool. In September 2024, we brought 6 out of 10 planned activities into the classrooms. In this work, we also present the preliminary results on 60 students and how we had to adapt the activities based on the context.

Keywords

AI Education, AI Literacy, Innovative Teaching, Ethics and AI

1. Introduction

Artificial intelligence has become part of many people's daily lives. However, from the authors' teaching experience, many users do not really understand how it works, overestimates its capabilities, and are frightened by it. This unconscious use reveals a big gap between the adoption of technology and the general public's knowledge of its implications. In order to try and mitigate this gap, the authors developed a series of ten workshops for Italian high school students with Discentis, a socially oriented innovative startup focused on educational innovation. The company's priority is to generate a positive, real, and measurable impact on students' learning journey. For this reason, the company's main products are training courses for teachers on innovative didactical methodologies and technologies, and hands-on workshops for students in the STEM (Science, Technology, Engineering, and Mathematics) field. The activities were developed in the framework of the Decreto Ministeriale n. 65 del 12 Aprile 2023 (published in G. U. 17 April 2023, n. 65), which is part of the PNRR "Mission 4" (National Recovery and Resilience Plan) - Next Generation EU. This decree focuses on promoting new skills and languages, as well as on strengthening STEM skills in schools, intending to reduce the gender gap and increase digital skills. These training pathways will involve state and private schools and have to be completed by 2025, in line with PNRR goals. Discentis proposal for STEM workshops consists of cycles of 2-hour-long meetings led by the start-up science facilitators. The proposed activities are designed not only to strengthen students' STEM knowledge, but also to develop soft skills such as critical thinking, advanced problem-solving, and strategic planning. All workshops offered to schools actively involve students and cover topics such as coding, robotics, and video games. In this paper, we will explore and analyse the methodologies and teaching practices that guided the creation of the ten AI workshops (section 2), the objectives of each activity (section 3.2) and the first results on the students encountered in September 2024 (section 3.3). All of the activities are focused on educating students on the cognitive, operational, critical, and ethical aspects of AI. The main goal of our workshops is to educate teenagers between

1st Workshop on Education for Artificial Intelligence (edu4AI 2024, https://edu4ai.di.unito.it/), co-located with the 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024). 26-28 November 2024, Bolzano, Italy

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14 and 19 years old on Artificial Intelligence: what it is, how it works, how to use it, and its ethical implications. Furthermore, we would like to reduce their fear of AI and to help them realise the AI is actually not smarter than them. As shown in [1], this happens when they try to actually program a model. For this reason, and to optimise the learner's experience, all of our workshops use a hands-on learner-centred approach. The first round of activities lays the foundations for understanding what AI is and what it is not, how it learns and what its problems are. In the first three activities, the class learns how to create an image classifier from scratch and evaluate its results. Then, they use their knowledge of classifiers to create a game that they can command with their body. We then introduce the students to the world of GenAI by teaching them how to create a Chatbot and how to properly write a prompt for an LLM. Using what they learnt on prompt engineering, they write and compose a song and generate photos and videos. The students also face the ethical aspects of AI in two different occasions: a structured debate on the ethical quandaries raised by AI (autonomous vehicles and digital surveillance) and a simulated legal trial where students examine the use of therapeutic robots. This cycle of activities is designed to provide a basic understanding of the theoretical workings of AI and its diverse application context. Furthermore, the intermediate and final stages of ethics and debate help develop a creative and personal approach to the world of AI. This study, therefore, aims to contribute to a broader discussion on educating people about a conscious and critical use of AI, with the goal of offering a methodological framework that can guide future educational implementations.

2. Methodological Background

2.1. AI Literacy

AI Literacy (AIL) was first defined in 2016 as the ability to understand basic knowledge and concepts surrounding the technologies on which artificial intelligence is based [2]. Since then, many different definitions have been proposed to include the ethical aspects of the interactions with AI tools, suggesting that AIL encompasses a set of skills that enable effective critical communication and collaboration with AI technologies [3]. A more comprehensive definition states that "AI literacy can be defined as the knowledge and understanding of the basic functions of AI and how to use AI applications in everyday life in an ethical manner. AI skills include the ability to read, work with, analyse and create AI" [4]. In this work, we will consider the four constitutive dimensions highlighted in the comparative analysis of these definitions [5]: Cognitive: To know and understand the fundamental concepts of AI, focusing on basic constructs, which do not require prior knowledge. Specifically:

- Definition and types of AI,
- Data and conceptual foundations of Machine Learning,
- Applications of AI [6].

Operational: Knowing how to use AI technologies effectively and in different contexts [[7],[8]]. The ability to solve problems using AI tools, and the ability to build AI applications to promote the development of analytical abstraction [9], are traced by other authors to the operational dimension in its more advanced stages. Critical: To consciously assess the social implications of AI technologies and use them critically, engaging students in cognitive, creative and critical discernment activities [6]. Given the increasing role of AI in decision-making processes in various fields, the ability to critically evaluate its impact is essential to foster a comprehensive understanding of the benefits and drawbacks associated with its various uses. Ethical: To understand the ethical issues related to AI, including transparency, explainability, fairness, privacy, and security. It is crucial to be able to take a balanced view of the sensitive ethical issues raised by it.

2.2. Teaching strategies

Our workshops employ teaching approaches and strategies that are widely found in educational literature. A special focus is placed on active pedagogy, constructivist approaches, and Project-Based

Learning (PBL). Below we outline the main methodological aspects and the literature supporting their use.

Active Pedagogy and Constructivism: The workshops are based on the constructivism theories of Piaget and Vygotsky and Papert's constructionism [10]. In the theory of constructivism, knowledge is conceived as a construction of personal experience. It cannot be received passively, but it is acquired thanks to the relationship between an active subject and reality. The constructionist approach extends the concept of constructivism, stating that learning is most effective when it involves a hands-on activity in which a meaningful product is constructed. An analysis of constructivism is well documented in [11], which argues that learning occurs best when students are involved in educational experiences that lead them to actively reflect and construct knowledge. Moreover, this type of approach has often been used in facilities such as FABLabs [12], and its effect on interest in STEM subjects and curiosity has already been studied [13].

Project Based Learning (PBL): Project Based Learning is a problem-solving oriented and project-centred teaching methodology. PBL is a powerful learning tool that promotes active involvement and critical thinking, as students are asked to solve real problems and produce tangible results [14]. Students working on projects develop a greater ability to apply knowledge to concrete situations and to recognise situations in which it is applicable. This approach also promotes the development of soft skills such as collaboration, problem-solving and critical thinking, as students are encouraged to confront complex problems and work together to find solutions.

In addition to these two main methodologies, the various workshops (Section 3.2) provided an opportunity to deploy other teaching approaches, which we will briefly discuss.

Differentiated Learning: The differentiation practice advocates the importance of adapting teaching content and methodologies to meet the different needs and learning styles of students [15]. During the first and second round of activities, students can develop creative and technical skills at different levels, depending on their previous experiences and personal interests.

Computational Thinking: One of the central aspects of DM65 is the development of computational thinking [16], a cross-curricular skill that includes problem decomposition, pattern recognition, abstraction and algorithm design. In the first group of workshops, students have to think like computer scientists, decomposing complex problems into more manageable parts, developing models and testing solutions.

Ethics and Socio-Emotional Learning: Education should prepare students not only to be technically competent, but also responsible citizens, capable of making informed decisions that take into account the ethical and social consequences of the technologies they use [17]. The last group of activities, focused more on the ethical issues in AI, adds an important socio-emotional dimension to the syllabus and helps developing an 'ethical conscience' among future AI developers and professionals.

3. Workshop Development

3.1. Technical Tools

Within the ten workshop activities, we included the use of user-friendly tools, so that even classes without any computer skills could approach the world of AI in a constructivist manner. All the chosen tools are free (or have an accessible free version) and we gave priority to those platforms that do not require any form of access, to avoid problems with school accounts as much as possible. Below is the list of tools considered:

- **Teachable Machine (© Google):** This platform allows the creation of well-functioning models with a relatively small number of images (or sounds or poses). It is extremely intuitive in its operation and also allows interaction with a camera. It has been used for introductory activities on learning AI models, bias problems in data, and evaluation of model performance.
- **Playground MIT (© MIT RAISE Initiative and the MIT Media Lab Personal Robots Group):** It is a block-based programming environment that supports the integration of projects created with Teachable Machine. It was utilised to develop an interactive video game that can be controlled using a pre-trained machine learning model.
- **Dialogflow (© Google Cloud):** Platform that allows the creation of a ChatBot from scratch. Although not as intuitive as previous platforms, it allows users to understand how more complex models work and is an excellent introduction to the world of language models.
- **ChatGPT (© OpenAI):** World-renowned LLM, certainly the best known in high school classrooms. It was used to work on prompt engineering and to get a first approach to generative AI.
- **Character AI (© Character Technologies, Inc.):** This site allows students to create a character from scratch. For each character, you can provide name, image, voice, and characterisation, and the user can create interactive conversations with anyone.
- **OpenArt (© OpenArt):** On this site, one can generate images from scratch or edit parts of existing images. Free accounts, however, have a very limited number of credits.
- **Suno (© Suno, Inc.):** This site allows you to create more or less customised songs. It is possible to generate both lyrics and music. Free accounts, however, have a very limited number of credits. This tool and the previous one can be used to start discussions on copyright.
- **Synthesia (© Synthesia LLC)** and **Colossyan (© 2024 Colossyan Inc.)** are AI-powered video creation tools designed to help users quickly generate high-quality videos using customizable avatars. Users can choose from various templates, upload audio files, and adjust features like accents, emotions, and scene transitions.
- **The Moral Machine** [18]: On this webpage, you can confront the ethical dilemma of self-driving cars. There are a series of ethical questions in which each time the user has to decide whether to crash into an obstacle, run over a group of people or run over a group of animals.

3.2. Activities Description

In this section, we briefly describe the ten workshops created. Those presented here are the early versions, built before the actual classroom experience, which, as will be made explicit, involved some consistent changes in the methodologies and timing of activities. The first round of activities focuses on artificial intelligence and machine learning basics. In “Discovering AI” students explore the foundations of artificial intelligence models, developing insight into how neural networks work and the management of datasets for training, validation, and testing. In the next workshop, “Let’s create our first classifier”, students collect data and build an image classifier, developing critical awareness of the importance of data and the biases introduced in models. The third activity, “Does My Model Work?”, is devoted to evaluating the models developed, with a focus on understanding and applying the confusion matrix, a key tool for analysing the performance of classifiers. At the end of this workshop, they also create a game that they can command with their body. The second cycle moves on to more specific applications of artificial intelligence in the field of communication and content generation. “Chatbots with Dialogflow” introduces participants to chatbots and language models. In this activity, students learn how to design intents and entities, fundamental concepts for creating intelligent conversational systems, while creating their own chatbot. This activity is propaedeutic for the one on “Prompt Engineering”, where we address the interaction with generative language models. Here, the focus shifts to refining prompt engineering skills, highlighting the impact of different formulations on the results. In the authors’ opinion, the reflection on these processes leads students to develop critical thinking in the use of generative tools, in a context that encourages metacognition and problem-solving. The modules “Create Your Song”, “Image Creation with OpenArt” and “Creating Videos with AI” capitalise on the skills learned in prompt engineering to explore the production of multimedia content. Here the students create songs, images and videos through platforms such as Suno, OpenArt, Synthesia and Colossyan. These labs highlight the potential and the actual limitations of AI in artistic creation and spark a conversation on copyright. The third group of activities is more ethical based. In "Ethical Issues of AI" students participate in structured debates on the ethical quandaries raised by AI, such as the accountability of decisions made by autonomous vehicles or the issue of privacy in digital surveillance. During the final workshop, "Sue the Seal", the students examine the use of therapeutic robots and related privacy and data security issues, while preparing for a simulated legal trial. These workshops not only enrich understanding of ethical challenges, but also develop argumentative and critical thinking skills. These ten activities are modelled to give a basic understanding of the theoretical workings of AI, on the one hand, and its multifaceted application context, on the other. The intermediate and final steps of ethics and debate are posed to develop a creative and personal approach to the world of AI.

3.3. Early Impact and Change in Progress

The activities were developed between August and September 2024 and were tested in classes in September 2024. Here we present the first author's initial considerations after testing the activities with two groups of students and making adjustments. These insights and changes help us draw initial conclusions, verify the effectiveness of the methodologies adopted and shed light on future, more structured work. The two rounds of workshops were delivered in a Hotel Management and Culinary Arts School in Turin, Italy. The school only commissioned six activities out of the ten presented in the previous section. They involved 60 (31 for the first and 29 for the second group) students at the beginning of the last year of high school (from 17 to 20 years old). Their participation in the workshop cycle was mandatory, and the activities were carried out outside the regular curricular activities. This context immediately created challenges, as the students involved had to remain at school while their classmates could go home, which negatively impacted their motivation and engagement. The first three proposed activities turned out to be difficult to grasp for the first group of students, possibly due to the lack of attention and interest on their part. Therefore, with the second group, we decided to make the workshops even more interactive and to insert competitions between the students to motivate them. This definitely improved the students' participation and it allowed us to introduce more complicated concepts, such as the confusion matrix. The fourth activity, initially planned as Dialogflow, was replaced with the prompt engineering workshop to better suit the students' skills. The final two workshops were completely revised to address issues with students' low attention and engagement, as the simpler initial activities were not successful, making the planned final tasks unfeasible. Therefore, we decided to stick with LLM and created two brand new activities involving CharacterAI. The fifth activity, called "Get Yourself Elected" saw students reflect on their ideal school to create a fake student representative using Character AI. After developing a school program and the characteristics of the character, each team had to create their perfect representative and to get the other teams to vote for them. This activity was way more successful than the previous ones: students were either engaged in trying to make the representative as votable as possible or they tried to make them as silly as possible. A few groups realised while creating the character that it didn't always obey its description and this sparked an impromptu conversation on the stochasticity of the models. The final activity guided students in creating a resume and a cover letter, using ChatGPT and Canva, and simulating a job interview with the help of Character AI. Students showed interest in developing transferable skills useful for real life, regardless of the focus on artificial intelligence. We conclude this section with a final reference to work [1], concerning students' awareness of the real smartness of AI tools. Figure 1 below presents the questions posed at the beginning and at the end of the workshop cycle. We asked the students whether or not AI was smarter than them, if they were frightened by AI and if they were curious about it. As we can see from the figure, while the level of curiosity remained stable, the students were sensibly less frightened. Moreover, the percentage of students thinking that AI was smarter than them significantly dropped. These results are in line with those in [1] and show that hands-on approaches are highly effective for AIL.

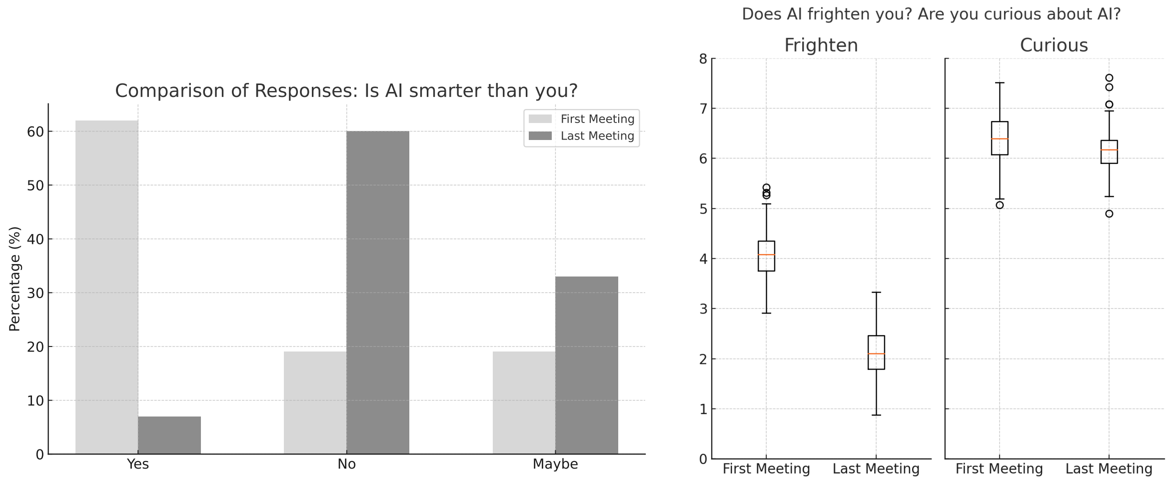

Figure 1: Questions asked at the beginning and at the end of the workshops series.

4. Discussion and Conclusion

The main goal of our workshops is to educate Italian highschoolers on what Artificial Intelligence is, how it works, how to use it, and its ethical implications. These workshops are meant to reduce fear of AI and to help students realise that they are smarter than technology. Even though the conditions of the first two cycles of activities were not ideal, some significant insights have emerged: after only six hands-on activities, the students' level of fear toward AI dropped significantly, as did the number of students who thought AI was smarter than them. We are aware that these are just early results and the sample size is too limited to draw general conclusions, but we mean to further explore this trend in the next cycles of activities activated in the territory of Turin, Italy. By the end of 2025, we plan to involve about 250 students from different backgrounds. In addition, we will investigate whether there will still be a significant difference between their perception of AI, in terms of fear and curiosity, and, in general, of intelligence, based on their relationship with STEM subjects. It is expected that the more comfortable students are with STEM subjects, the more curious they will be about AI, the less apprehensive they will be, and the more intelligent they will perceive themselves to be. Also, we plan to explore gender differences in responses. Moreover, based on our recent experience, we would like to suggest to anyone planning on educating people on AI to shift away from overly ambitious goals when students' engagement and self-interest are poor. Focusing on easier and smaller tasks that offered immediate and conclusive gratification allowed students to achieve concrete results in the short term, thus fostering more active and engaged participation. In conclusion, this study would like to propose a methodological framework that can guide future AIL implementations and aims to contribute to the wider discussion on the conscious and critical use of AI.

Acknowledgments

We would like to thank Federico Floris for his help in building the activity cycle and Elisa Marengo for delightfully suggesting to submit the article. We would also like to thank the Discentis team that revised the activities with us. The activities were developed in the framework of the Decreto Ministeriale n. 65 del 12 Aprile 2023, (published in G. U. 17 April 2023, n. 65), which is part of the PNRR "Mission 4" (National Recovery and Resilience Plan) - Next Generation EU.

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