Chapter 1
Artificial Intelligence and Machine Learning Education and Literacy:
Teacher Training for Primary and Secondary Education Teachers

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ABSTRACT

Artificial intelligence (AI) education and literacy are gaining momentum over the past few years; AI systems are permeating our daily lives and mediate our social, cultural, and political interactions. The implications of AI extend beyond the technical aspects and involve ethical, cultural, and social issues such as misinformation and bias. Understanding how an AI system works and critical thinking skills have, therefore, become ever more crucial for children and young people in order to be able to identify the benefits and challenges of AI. The role of the educators is, at this point, critical. This chapter is situated in the context of AI education and literacy and aims to propose a framework for teacher training on AI and ML education. The design of the teacher training courses and initial findings are described. Through an exploratory approach, insights on the attitudes, the requirements, and the recommendations of the teachers emerged.

INTRODUCTION

In this chapter a framework for teacher training in Artificial Intelligence (AI) and Machine Learning (ML) education and literacy, for primary and secondary education students is presented. The main components of the framework are introduced and discussed, such as principles, relevant AI concepts and means to communicate them, educational approaches, and educational material, as well as preliminary insights from implemented teacher training workshops. AI refers to the processes and algorithms through which an application learns to perform tasks such as problem-solving and decision-making. ML is a subset of AI and involves a set of algorithms through which a system adapts and improves its performance by processing and analyzing data (Webb et al., 2020). AI and ML applications are currently ubiquitous in everyday life; they have a positive impact in areas such as healthcare and education; they further mediate our social, cultural, and political interactions through, for example, search engines, voice and face recognition applications, recommendation systems, and personalized information in newsfeeds and social media (Rahwan et al., 2019; Webb et al., 2020). Concerns, though, have also been raised regarding the role, the challenges, and the limitations of AI and ML in areas involving ethical decisions, autonomous systems, and the delivery of information (Russell et al., 2015). AI education and literacy seems to be even more critical now. Children and young people need to be able to understand how AI and ML works and develop critical thinking skills for identifying the benefits and challenges of AI, access and assess information and data, and recognize cultural and social bias embedded in the design of AI systems (Hsu et al., 2018; Koltay, 2011). In this context, the goal of this chapter is to introduce a framework for the training and support of teachers regarding AI and ML education and literacy of primary and secondary education students.

Our framework aims to address understanding of the technical aspects, the key elements, concepts, and principles of AI and ML such as Supervised Learning and Reinforcement learning, and also encourage critical thinking of students and teachers on the ethical, societal and cultural implications of AI. The role, the benefits, and the challenges of AI could become clearer and more meaningful to students and teachers if an interdisciplinary approach is adopted, highlighting the links between AI and a wide range of fields such as sustainable development, healthcare, economy, history, mathematics, and art (Rahwan et al., 2019; Vinuesa et al., 2020.) Therefore, our target group for this teacher training course was not only computer science teachers but also other school subjects such as History, Arts, and Literature. For our framework we considered the varied levels of AI or computer programming expertise and understanding of educators, and the diversity of disciplines and education levels.

Work described in this chapter is situated in the context of the Erasmus+ Learn to Machine Learn project (LearnML) which aims to develop a framework and a toolkit of AI and ML education through game-based learning resources and activities. The LearnML project is a three-year Strategic Partnership in the field of Education aiming to produce an innovative solution for the teaching and learning of crucial 21st century skills relating to digital literacy, computational thinking, AI, and ML. In the framework of this project, the partners conducted workshops with teachers from primary and secondary education. The consortium developed a network of stakeholders and particularly educators, so as to engage in reflective discussions through meetings and workshops during the teacher training phase. This chapter describes the process and the results of the teacher training phase; the materials and resources used to further refine the teacher training process are further presented. The workshop participants' ideas and concerns about AI and ML were recorded. Data collected, such as participant observation notes, facili-

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