Teaching Artificial Intelligence for Non-computer Science Students in Undergraduate Education: A Competency Framework and an AI Course (Doctoral Consortium)

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ABSTRACT

Artificial intelligence (AI) systems are saving time, reducing costs, and human efforts to perform tasks in diverse fields such as education, medicine, finance, and journalism. This growing relevance of AI in different domains brings a need to prepare future professionals in undergraduate education to use AI technologies effectively and responsibly in their careers. Through AI literacy in undergraduate education, non-computer science students can become prepared to use AI methods and tools to bring benefits (e.g., saving time, better outcomes) for their domains/future jobs, understand and increase awareness of the ethical, social, and legal issues raised by AI and critically evaluate these technologies when using them in their future jobs. Based on that, the main objective of this research is to develop an undergraduate AI course based on a competency framework that will empower future professionals from different domains with AI knowledge and skills.

CCS CONCEPTS

• **Social and professional topics** → **Adult education**; • **Computing methodologies** → *Artificial intelligence*; • **Applied computing** → Computers in other domains.

KEYWORDS

AI education, undergraduate education, competency-based education

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1 INTRODUCTION

Artificial intelligence (AI) systems are developed using machine learning and/or logic- and knowledge-based approaches and can, for a given set of human-defined objectives, generate outputs such as contents, predictions, recommendations, or decisions, influencing the environments they interact with [6]. These systems have emerged as one of the most prominent technologies in various fields, for instance, medicine, education, law, and journalism [14]. Since AI systems are becoming prominent in various fields [14], there is a growing demand for professionals with AI skills in different fields in the labor market [1]. These professionals are being increasingly required to use AI to lead to innovative and enhanced outcomes in their fields [1] and to safely, critically, and ethically interact with AI in their jobs [7].

In light of these motivations, there has been an increasing number of contributions promoting AI education for non-computer science students in undergraduate education to prepare them for these AI-based workplaces [3, 5, 10, 11, 15, 17, 19, 20]. Most of the contributions aimed to present or describe an AI course/program for non-computer science students in tertiary education institutions [3, 4, 10, 11, 19, 20], and a smaller amount of contributions propose a technology [17] or learning material [15], or propose an AI educational model [10].

Nonetheless, theoretical contributions that thoroughly investigate and list core AI competencies relevant to this audience and that can effectively guide the development of AI courses in universities are highly needed for the field's maturity. Despite there are theoretical contributions in the broader AI education research field that have proposed AI competencies for K-12 and general non-technical audiences [8, 12, 13, 16], these are different audiences. Non-computer science students in undergraduate education specifically may have distinct needs when it comes to AI competencies. For example, since AI systems can have adverse effects such as bias perpetuation, privacy and copyright violations, misinformation dissemination, manipulation facilitation, and security concerns [2, 18], researchers are advocating for future professionals to receive education on how to safely, critically, and ethically interact with AI in their jobs [7]. In addition, for instance, researchers point out the importance of multidisciplinary teams developing AI systems [7] since AI development benefits from interdisciplinary knowledge [9].

Therefore, to effectively equip non-computer science students in undergraduate education with core AI competencies, it is essential to specifically investigate which competencies are relevant for them to acquire and develop an AI course driven by these competencies in order to prepare these future professionals for this evolving workplace. Based on it, this research aims to investigate which core AI competencies are relevant to be included in the undergraduate education curricula of non-computer science students, propose an

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AI competency framework, and develop an AI course that prepares the students to acquire these suitable and required core AI competencies. This research seeks to answer the following research questions: RQ1- What core AI competencies should non-computer science students in undergraduate education acquire?; RQ2- What teaching methods, materials, and tools are suitable for developing or adopting to foster non-computing students' core AI competencies in undergraduate education?; RQ3- What are the effects of the AI course on fostering non-computing students' core AI competencies in undergraduate education?

2 METHOD

To address AI to non-computer science students in undergraduate education, it is necessary to thoroughly investigate which core AI competencies are relevant to be included in their curricula in order to prepare them effectively for AI-based workplaces. Therefore, the first step of this research is to develop a competency framework that can be adopted to inform AI education for this target audience at the undergraduate level. Since the target audience of this project is from different domains (such as students from journalism, anthropology, physics, and arts), the competency framework development will be co-designed with a multidisciplinary expert audience. The competencies will be acquired through the outcomes of (1) semi-structured interviews with professionals working at the intersection of AI and other domains, (2) a systematic literature review of the current AI education literature for non-computer science students at the undergraduate level, and (3) analysis of AI competency frameworks for other audiences. The competencies acquired through these different methods will be merged, and a list of core AI competencies for this audience will be created.

Afterward, a Delphi method study will be conducted with a multidisciplinary expert audience to reach a consensus on which core AI competencies this target audience should acquire and propose a version of the competency framework. The next step of this work, based on the competency framework, is to define the AI curriculum and the teaching methods and develop or adopt materials and tools that will compose the teaching-learning units of the AI course. To achieve this objective, AI education open learning materials and literature will be analyzed, as well as AI literature, books, and policy papers to support the development of the teaching-learning units. After the development of the units of the AI course, participatory design workshops will be conducted with students to collect their perspectives, opinions, motivations, problems, and suggestions to update and improve the AI course. The final step of this work is to conduct experiments to evaluate the impact of the AI course on fostering students' core AI competencies.

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