Enhancing artificial intelligence literacy through cross-cultural online workshops

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ABSTRACT

This article presents the results of a study conducted in collaboration with two universities – one in Lapland (Finland) and the other in Hong Kong (China) – during the development of an international university course on global media education. The objective of the study was to examine international students’ changing conceptual understanding of artificial intelligence (AI) literacy as part of the course. The need for this study arose from the recent rapid spread of AI across industries, which has connected human learning to machine learning. This requires competence in AI to contribute to future society. Five hours of online lectures on AI literacy were delivered during two workshops to students (N = 29) from 13 countries with no or limited prior knowledge of the subject in 2021 and 2022. The participants filled out pre- and post-workshop quantitative questionnaires and wrote diaries about their learning process, the development of their understanding of AI-literacy concepts, and their thoughts on the pedagogical approaches used. The quantitative data were analysed using a paired-samples t-test, while the qualitative data were examined using thematic-content analysis. The findings show that the students’ knowledge of AI and their awareness of the importance of AI literacy and media education increased significantly. Further research is needed so that a more appropriate curriculum can be designed for them. We outline some key activities that offer interactive and participatory ways to learn AI in order to assist educators in planning and delivering AI-literacy courses as part of cross-cultural media education.

Introduction

This article explores artificial intelligence (AI) as part of a university-level media education course. Media education seeks to promote awareness of the development of a multimodal digital media and communication landscape that offers opportunities for consuming and creating content. It promotes critical thinking about, with and through any form of media [18]. Digital literacy has evolved from functional literacy (i.e., being able to read, write and calculate) to another form of literacy that consists of the ability to use technology for communicating, learning and performing other activities in order to participate in today’s society [12,48]. AI literacy commonly refers to the capability of comprehending, using, monitoring and engaging in critical reflection on AI applications, even if one does not possess the expertise to create AI models [26,35]. Hence, media education encompasses the concept of AI literacy as part of digital literacy, which allows one to critically evaluate and use information, thus transforming it into knowledge [7].

AI is a technology that mimics human intelligence and has the ability to learn and solve problems. In recent years, it has developed rapidly [31,46] and radically changed how people live, learn and work [22,24,48]. Therefore, today’s society requires basic competence to use this technology [48]. The era of AI necessitates the development of learners’ diverse functional, social and technical competencies [48]. The concept of AI literacy reflects this diversity. It is defined as an individual’s competence in using, critically evaluating and communicating with AI as a subjective and independent human [29,48]. Furthermore, it encompasses a person’s competence in using AI to realise their goals and protect their personal information; this makes awareness of the fundamental concepts of AI pivotal in today’s globalising digital world [22]. For these reasons, developing AI literacy – the ability to understand the technology and use it effectively – through a less technical and more participatory approach is essential at all levels of education [23,30].

Given the rapidly expanding role of digital technologies and AI in society, teacher education programmes everywhere should equip future
teachers with the confidence and competence to adapt to the complex and changing nature of teaching, which requires wide-ranging expertise developed and updated over time, so that new topics and themes can be introduced to learners [4]. The report by the United Nations Educational, Scientific and Cultural Organization [45] on K-12 AI curricula states that 11 countries have AI curricula that are officially supported by their governments and that a few other nations are in the process of developing such curricula. However, there exists a significant disparity between the abilities and knowledge taught in educational institutions and those that are essential in the workforce and broader society in the era of AI [45]. Hence, there is a need to increase the production of resources for the growing field of AI [4] and create opportunities to learn about AI in teacher education. Furthermore, research on the current state of AI in education is still in its infancy, and there is a need to know what content should be taught to learners with limited prior knowledge of AI, who often include humanities students [26].

Given this situation, an international university course on global media education that incorporated AI literacy as one of its focal points was developed. This article looks at the experiences with AI of this course’s students in 2021 and 2022. It asks the following questions:

1) How did the students’ AI literacy develop during the online workshops?
2) What were the main takeaways of the AI-literacy workshops according to the participants?
3) How did the students experience the teaching method of the workshops?

This study contributes to the scientific debate on AI-literacy learning and reveals practices that promote such literacy among students with the goal of preparing them for the world of work. The findings may also be valuable for policymakers and administrators developing initiatives and solutions for the implementation of AI-literacy education.

**Literature review**

The role of teachers and teacher education in the use of technology and AI

Teacher education is considered a perpetual training and professional-development process for both pre-service and in-service teachers [13,39]. It refers to the policy-based activities and practices that equip teachers with the pedagogical, ethical and thematic competencies necessary to effectively carry out their responsibilities and contribute to society’s development [39]. The pedagogical use of technology in teacher education programmes plays a critical role in preparing pre-service teachers for their future working lives and in nurturing teachers and learners to become active and informed members of society [44].

Technology use in education faces various challenges, such as access to infrastructure, affordability, a lack of institutional support and a dearth of teacher educators who can teach successful pedagogical technology integration [3]. Amaghu et al. [1] found that teacher educators’ digital-tool use was not primarily for pedagogical purposes. Furthermore, the studies by Farjon et al. [16] and Spiteri and Cheung Rundgren [43] revealed that, among pre-service teachers and primary teachers, the most significant influences on technology integration into instruction were attitudes and beliefs as well as competencies. These elements affected the school culture but were also affected by it. These challenges (as well as other ones, including reliability and trust issues) regarding AI-powered technology concern educators worldwide [8,34]. A study by Chounta et al. [10] investigated Estonian teachers’ perceptions of AI in education. Estonia ranks first among the 27 countries of the European Union based on the Index of Readiness for Digital Lifelong Learning [5]. The findings of Chounta et al. [10] highlighted teachers’ limited knowledge of AI and sporadic use of it at work. However, AI was perceived as an opportunity for education and as something that can bring considerable improvements to all areas of human life. Still, its use can have other challenges in addition to those mentioned above, which are linked to its ethical use and privacy [10,19]. Also, algorithms’ unfairness and bias can amplify negative stereotypes and inequity [10,20]. Hence, stakeholders, including teachers, teacher educators and policymakers, need to be told in layman’s terms the potential dangers, benefits and fundamental concepts of AI for education [22,42]. This will result in enhanced AI literacy [22]. In turn, thanks to this, these stakeholders could recognise the added value of digital and AI technology use in their specific teaching and learning environments. This recognition could help enhance motivation and change beliefs and attitudes by providing tangible, efficient and subject-specific successful examples demonstrated by competent teachers [1].

**AI themes for non-technical international higher education students**

The education sector is significantly influenced by AI applications that have the potential to transform it by, for example, personalising instruction and learning as well as automating assessment and administrative tasks [9,40]. Therefore, it is important to increase the theoretical and practical knowledge of AI use in educational contexts among pre- and in-service teachers as well as teacher educators [22,34]. Rott et al. [37] studied different pedagogical approaches to AI-powered educational technology use in the vocational education context. They found that the action- and interaction-oriented approach and the student-centred one were very useful, which is in line with the studies by Kong et al. [23], Luckin et al. [30] and Sanusi et al. [41]. Nazaretzky et al. [34] recommended that when teaching educators about AI technology, basic practices and procedures that are common in AI should be taught with concrete pedagogical tasks. Furthermore, educators should learn to recognise the (in)accuracy of AI-produced content depending on its context [34].

Recent studies have also proposed various AI-literacy themes that should be taught to education or humanities university students [26]. For instance, Liu and Xie [28] have suggested strengthening students’ competence in digital literacy, programming and computational thinking, whereas Olari and Romeike [36] have highlighted the significance of data literacy expertise. Lee [27] found that the following three themes foster AI literacy: the understanding of AI, the ethical questions about the technology, and its efficient use. Long and Magerko [29] defined the following 17 competencies as necessary to become AI literate: recognising AI, understanding intelligence, interdisciplinary, general vs narrow AI, AI’s strengths and weaknesses, imagining future AI, representations, decision-making, machine learning steps, human roles and AI, data literacy, learning from data, critically interpreting data, action and reaction, sensors, ethics, and programmability. Sanusi et al. [41] suggested that three types of competence are intertwined with the ethics of AI and are central to learning AI literacy. The first one is knowledge competence, which includes cultural and skills-related competencies. The second one is learning competence, which comprises self-learning and cognitive expertise, and the third one is team competence, which includes teamwork and human–(AI) tool collaboration.

The findings discussed above are in line with those of Laupichler et al. [26], who compared 30 studies of AI literacy in higher education. Most of the courses surveyed in these studies covered machine learning and deep learning, which demonstrates the importance of these topics as the basics of AI-literacy courses. The authors also found that students from non-expert subjects seemed to rate these courses positively and understand their benefits. Wong et al. [47] arrived at similar conclusions after investigating how AI could be incorporated into the K-12 curriculum in Hong Kong. While younger students could start by learning how AI interacts with us and its applications in daily life, high school students could focus on more advanced topics, such as a conceptual understanding of algorithms and how to use them for problem-solving. Zhang et al. [49] shared another concrete example of how AI-literacy initiatives
have been implemented. Their 30-hour curriculum aimed to better prepare the participating students for their future career development. The curriculum covered various topics in machine learning (e.g., supervised learning) and deep learning (e.g., neural networks) to set the stage for further reflection on AI-related ethical issues. The curriculum was delivered to 25 middle school students enrolled in a summer Stem programme. Overall, the participants demonstrated a better understanding of AI after going through the curriculum; they could also identify related ethical issues.

Eguchi et al. [15] developed an AI curriculum for K-12 students in Japan. As part of this effort, they promoted the importance of adjusting instruction to the local culture in order to provide relevant context for students’ understanding and reflections on AI ethics. Culturally responsive teaching emphasises the recognition of students’ cultural identities and their integration into the learning process, thus incorporating their prior experiences and ways of thinking into the curriculum. It adapts materials and activities to reflect students’ cultural characteristics, thereby improving their self-image and promoting social consciousness [17]. Culturally responsive computing education links learners’ culture and computer science so that students can see the relevance and significance of their culture in said science [32]. The common denominator among all the above studies seems to be the ethical use of AI. This requires basic knowledge of machine learning, digital literacy, critical thinking skills and awareness of learners’ diversity.

**Design of the AI-literacy online workshops**

Based on the findings of previous research on the themes and pedagogical approaches to teaching AI literacy to students with little or no knowledge of AI and coding, we designed the workshops’ content and approach. These reflect the ideas of interactive and participatory learning [23,30,37,41], including in online contexts [25], as well as some flipped-learning characteristics [21] (Fig. 1). In the past, courses on AI were often designed with computer science students in mind; they thus had coding as a prerequisite [33]. Our AI-literacy workshops were designed to avoid this in order to remove the entry barrier for students with no programming background. Zhang et al. [49] adopted a similar approach when promoting AI literacy to middle school students. We believe it is important to promote students’ learning about AI and its possibilities through interactive exercises, both individually and in groups, so that the used online platform becomes a social and participatory learning environment. The previous section argued for machine learning and deep learning as important themes in AI-literacy courses with non-technical students. However, due to constraints on class time, only machine learning was covered in our workshops.

**WHAT TO DO:**

Before the first class:
- Pre-lesson reading to familiarize with the topic
- Pre-lesson reflection on prior knowledge

During the first class:
- Introduction to AI and AI in daily life
- Why learning about AI?
- Highlights of history of AI
- Highlights of ethical issues related to AI
- Discussions led by pre-set questions on AI and its future in our lives. Encourage student-student and student-instructor interaction and communication.

After the first class and before the second class:
- Pre-lesson reading to familiarize with the topic

**WHY TO DO:**

Flipped classroom learning approach prompts students to be reflective of their prior knowledge and the relevance of the topic to themselves. It also prepares students to be active for learning in the first class.

Students are given participatory online learning activities and encouraged to be active in engaging with the class materials, be interactive with the others and be constructive to form their own opinions through:
- Class topics and discussion threads that students can easily relate to
- Interactive and accessible platforms for students to explore various aspects of AI, thus encouraging deeper understanding by students and further discussions.

Flipped classroom learning approach prompts students to be reflective of their own prior knowledge and the relevance of the topic to themselves. It also prepares students to be active for learning in the second class.

Students are given participatory online learning activities and encouraged to be active in engaging with the class materials, be interactive with the others and be constructive to form their own opinions through:
- Chosen examples that students can easily relate to
- Interactive and accessible platforms for students to explore various AI algorithms, thus encouraging deeper understanding by students and further discussions.

The approach to focus on AI concepts makes the topics accessible to students without much background in programming.

**Fig. 1.** Interactive online-teaching activities for AI literacy.
Before the first day of the workshop (Fig. 1), the students were provided with pre-class readings (as per the flipped-learning approach) so that they could become familiar with the content; this, in turn, would increase the interaction time during the workshop [21]. The students were encouraged to reflect on their prior knowledge of the topic; to understand this, learning diaries, a pre-workshop test and a survey were used. The first workshop day familiarised the participants with the topic of AI, offered some elements of AI’s history, and introduced machine learning. At each stage of the workshop, discussion and activities were encouraged; also, opportunities for practical exercises were offered so that students were not passive observers. After the first workshop, the participants reflected on their learning and explored more content for the second workshop. The aim was to support the students’ development in terms of self-reflection and prepare them to be active during the next workshop.

The second workshop started with discussions about machine learning and the algorithms involved in this type of AI. Practical examples were given to connect the learning to everyday life. The participants explored the topic further in pairs and groups through interactive exercises performed on accessible platforms, such as Teachable Machine by Google (https://teachablemachine.withgoogle.com/). The discussions in pairs and groups were organised in breakout rooms on Zoom and Teams. After the workshop, an assignment was given, which had to be completed either individually or in pairs; there was room to adjust the assignment accordingly. Students working in pairs could collaborate, for example, via a Google Doc on Google Drive. This was followed by the writing of reflective diaries and an assessment conducted with a survey similar to the one used at the beginning of the course. Doing so enabled students and teachers to determine how much the former’s knowledge of AI had improved.

Methodology

Participants

Elements of AI literacy were taught to 29 education students from 13 countries in Europe and Asia in 2021 (N = 13) and 2022 (N = 16) as part of a global media education course at the University of Lapland (Finland) during two workshops held each year. Of the students, 76% had no prior knowledge of programming, which is commonly thought to be a prerequisite to comprehending AI concepts [33]. The course was held partly in a hybrid format (online and face-to-face participation simultaneously) and partly in the classroom. Each year, the lectures and workshops (20 h) were delivered by international teachers; the AI-literacy workshops (5 h) were held online (via Teams and Zoom) by counterparts at the Education University of Hong Kong. As a flipped-learning approach was adopted for this part of the course, the participants were given the materials they had to familiarise themselves with prior to the lectures.

Research design

We employed mixed methods with a convergent parallel design, which involved the collection and analysis of both quantitative and qualitative data [11]. This approach was particularly fitting as the two data collection methods were considered equally important; the qualitative data was deemed capable of confirming and extending the statistical findings, thus allowing a multilayered view of them [38]. Furthermore, we used concurrent timing for the qualitative and quantitative strands (Fig. 2). After the analysis, the results of the two datasets were merged to find answers to the study’s research questions. The qualitative findings answer the first research question, while the qualitative findings answer the second and third research questions.

The combination of quantitative and qualitative research enabled us to capture the students’ experiences of and views on AI literacy from two perspectives – the close-ended data of the questionnaires and the open-ended data of the learning diaries [11]. The goal was to obtain complex information from a relatively small number of students and paint a detailed picture of their opinions and experiences [11]. We also sought to find consistencies and inconsistencies as well as mitigate the weaknesses of the two methods [38].
To measure the development of AI literacy (research question 1), the students were asked to fill out quantitative questionnaires before and after the workshops. To understand their self-perceived progress, the participants were told to reflect on the course in their learning diaries after each lecture and workshop. The pre- and post-workshop surveys had one open-ended question in which the students were asked to summarise and reflect in 100–200 words on their understanding of AI. In 2022, all the students filled out the surveys and completed the learning diaries. In 2021, all the students completed the learning diaries, but they did not respond to all the questions in the pre- and post-workshop surveys (9 students out of 13 answered in one question category, while 11 students answered in another category).

The two quantitative instruments used in this study were based on Kong et al. [22]. The first one was a concepts’ test for quantifying students’ grasp of AI concepts after attending the workshops. It consisted of 15 multiple-choice questions, each with four answer options. The questions followed closely the topics covered in the workshops and aimed to assess the participants’ skills (e.g., understanding, applying and analysing) in line with the revised version of Bloom’s taxonomy [2]. For example, one question from this test was, “Which algorithm for supervised learning involves the concept of ‘birds of a feather flocking together’?” A higher score on this test indicated better acquisition of AI concepts from the workshops. The reliability coefficient (Cronbach’s alpha) of this test was 0.77.

The second quantitative instrument measured students’ self-evaluated level of AI literacy. This survey used a 5-point Likert scale and asked the students to judge 10 statements from strongly disagree (1) to strongly agree (5); hence, a higher score in this survey showed that the students felt more AI literate. This instrument aimed to quantify AI literacy from the following three perspectives [23]:

1) Confidence in mastering AI concepts (e.g., “I know how to provide data for the computer to learn”).
2) Confidence in utilising AI for evaluation purposes (e.g., “I can tell whether a technological product used AI”).
3) Confidence in making use of AI to understand the world (e.g., “I know how to employ AI to solve real-life problems”).

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The reliability coefficient (Cronbach’s alpha) of this survey was 0.95.

**Procedures**

When the participants arrived for the first lecture, they were informed of the course content and that they were expected to write a reflective learning diary after each lecture as the course assignment. The students gave written consent to the use of their diaries for research purposes via Moodle, where all the course materials were uploaded. They were also informed that they would be given questionnaires to fill out during the workshops and that doing so was voluntary. At the beginning of the first workshop, the participants were informed again that participation was voluntary, after which they were asked to take the test and complete the AI-literacy survey. This served to establish how much previous knowledge of AI the students had and their initial level of self-perceived AI literacy. The participants then proceeded to the lectures. After the last workshop, the students were asked to take the test and complete the survey again, which allowed the comparison of the pre- and post-workshop responses. The quantitative data were analysed with IBM Statistics SPSS v. 22 (IBM, Armonk, NY, USA). T tests were used for the comparison of means.

The learning diaries were examined using thematic-content analysis [6] in six phases. We adopted a semantic approach as we were interested in the students’ opinions and experiences. The six phases were as follows: 1) Initially, the first three authors independently familiarised themselves with the data and found all the texts that concerned AI. 2) Then, they generated preliminary codes from the diary extracts regarding the AI-literacy workshops, 3) which was followed by a search for the initial themes and categories concerning AI. 4) After examining the data, the first three authors together reviewed and 5) defined the main common themes and categories about the students’ thoughts on AI (Table 1). 6) Finally, the first three authors extracted quotes (Table 1) that expressed the participants’ views particularly well, these were then discussed with the other authors to achieve consensus on the most relevant quotes, and the findings were written up [6].

Since all the participants were studying education, they reflected on the pedagogical methods used to introduce AI literacy to them, which gave us valuable insights into how this new topic can be disseminated to learners.

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**Table 1**

<table>
<thead>
<tr>
<th>RESEARCH QUESTION</th>
<th>THEME</th>
<th>CATEGORY</th>
<th>CODE EXAMPLES</th>
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<tbody>
<tr>
<td>2. What were the main takeaways of the AI-literacy workshops according to the participants?</td>
<td>Learning about AI and machine learning with international teachers and students</td>
<td>Students’ pre-knowledge of AI and machine learning</td>
<td>“At the beginning of this course, my vision of AI was mostly related to computer systems. When I was thinking of AI, I was sometimes afraid of the loss of control that we could have in our world if the computers replace humans.”</td>
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<td></td>
<td>AI use in daily life</td>
<td>Students’ developing competences Learning in cross-cultural environment</td>
<td>“I also learn that humans and AI should work together, because they both have different and complementary strengths.”</td>
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<td></td>
<td>Ethical use of AI and machine learning</td>
<td>Moral dilemmas Changing society’s needs Fears</td>
<td>“As seen in class, AI needs to be taught to react in a certain way during a particular situation. It means that a group of people is deciding about the intelligence of a technological object. Which part is left to transparency? Most of the time we have to simply trust the scientist community and creators of the technology surrounding us, which can be frightening.”</td>
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<tr>
<td>3. How did the students experience the teaching method of the workshops?</td>
<td>Pedagogical methods and learning experiences</td>
<td>Exercises and activities Experiences with AI and machine learning Motivation</td>
<td>“The reading material that we received to read during the time between the first and the second session of the Artificial Intelligence workshop was a lot to take in. The content was very concise and the topics very scientific. Nonetheless, I gained a lot of new knowledge thanks to the reading, and during the workshop the information become clearer and more understandable, as it was backed up with examples and ways of using the knowledge.”</td>
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Results

The development of students’ AI literacy

This study investigated the development of AI literacy among international students with limited prior knowledge of programming during a series of workshops. The results of the paired-samples t tests comparing the means of the pre-workshop survey (fall 2021 mean = 6.78, SD = 1.79; fall 2022 mean = 4.75, SD = 1.69; combined mean = 5.48, SD = 1.96) and the post-workshop survey (fall 2021 mean = 9.89, SD = 2.80; fall 2022 mean = 9.00, SD = 2.48; combined mean = 9.32, SD = 2.58) indicated a statistically significant improvement in the understanding of AI concepts. A repeated-measures t-test found the difference to be statistically significant in 2021 (t(9) = 5.52, p < 0.01), in 2022 (t(16) = 5.84, p < 0.001) and in the two years combined (t(25) = 7.496, p < 0.001). The second paired-samples t-test compared the students’ self-perceived mean level of AI literacy in the pre-workshop survey (fall 2021 mean = 2.55, SD = 0.58; fall 2022 mean = 2.91, SD = 0.54; combined mean = 2.77, SD = 0.58) and the post-workshop survey (fall 2021 mean = 3.74, SD = 0.52; fall 2022 mean = 3.65, SD = 0.46; combined mean = 3.69, SD = 0.48). As was the case with the first test, this t-test revealed a statistically significant improvement in the participants’ level of self-perceived AI literacy in 2021 (t(11) = 5.40, p < 0.01), in 2022 (t(16) = 5.49, p < 0.001) and in the two years combined (t(27) = 7.36, p < 0.001). These findings are supported by the small reflective writing task included in the surveys. For example, several students expressed their fears concerning the unfamiliar subject of AI. However, after the course, they were happy to have found the courage to attend and learn about it, and they felt considerably more confident about AI topics.

The takeaways of the AI-literacy workshops

The thematic-content analysis of the students’ learning diaries revealed that the takeaways of the AI-literacy lectures were knowledge of AI in daily life, the ethics of AI, and machine learning. The history of AI was not mentioned, even though it was covered during the lectures. It seems that the participants appreciated more the real-life connection of the course content and how it affected people’s lives, as well as what people should know about AI and how to use it effectively and ethically. The basic knowledge of how machine learning functions was well received as it lessened the fear of AI and showed humans’ role in it.

The learning diaries revealed in more detail the above-mentioned themes and categories as well as the students’ uncertainty, which was due to the fact that most of them initially had no or very little knowledge of programming and AI. In the diaries, the participants often reflected on how AI will influence daily life in the future. They also discussed the need for AI literacy when sharing their feelings of uncertainty regarding the technology’s ethical use. The following is a relevant extract.

I found the most interesting issue to be the moral dilemma caused by AI. There can be bias in research done by AI, and algorithms are written by specific groups of people.

The students also expressed their enjoyment in gaining an understanding of machine learning.

The most fascinating moment for me was when I realised how useful machine learning can be in our daily lives.

Furthermore, the participants liked the interaction in cross-cultural groups, and they seemed to benefit from the teachers’ diversity.

Meeting people from other cultures and communicating with them was a very nice experience and an opportunity. I think it is very interesting to see differences in speech, expressions and ways of greeting.

Attending lectures held by teachers from different institutions in different countries was very motivating. It was not like my university back home. In my opinion, this contributed a lot to learning more about the topic.

This evidence shows that the students learnt not only about AI literacy during the course but also about diversity and cross-cultural communication.

Experiencing the workshops’ teaching method

Regarding the pedagogical approach, interactive and collaborative online exercises with prior reading were clearly a good way to introduce the students to a topic of which they had limited or no prior knowledge.

In my opinion, the course was very cleverly planned and interesting; it was suitable for those who lack IT and mathematical knowledge. It included repetition, exercises, and quizzes to assess our knowledge at the beginning and the end of the workshops. The course truly was tailored to our learning needs.

The most interesting part of both workshops was the interactive exercises. These tasks brought me closer to the topic.

As future teachers, the students also thought about their expected work and how they would teach AI to children.

What I learnt and kept from this lesson is that, overall, I would also teach children about how and when AI can be used and how it helps us. Children will grow up in a digital world, and learning about AI will help them not only in their daily digital-tool use but also in some of their professions. I will also teach them about AI’s moral limits, which we covered in the first workshop.

This excerpt shows that this student understood the purpose and content of the course, the significance of the imparted knowledge for every person, and the importance of educating children about AI for their own benefit and that of society.

Discussion

In this article, we present the takeaways of a series of AI-literacy online workshops delivered to international students enrolled on a global media education course offered at the University of Lapland by international lecturers. We also explore the students’ experiences of the pedagogical methods used during the workshops. Our study shows that students from diverse backgrounds with limited programming expertise significantly improved their AI literacy; it also confirms that this made them feel more competent and able around AI. The participants expressed their positive thoughts about the pedagogical methods used in the online course and their interactions in the international student groups. They felt they had gained an understanding of other cultures and learnt to communicate better, even though the topic of the course and the assignments were focused on AI literacy. Our findings allow us to present practices that promote students’ AI literacy in collaborative, interactive and reflective ways.

We believe that there is a need to deliver knowledge about AI to students in higher education, specifically in teacher education, to enable future members of society to contribute to and actively function in their communities [14,24]. Based on our findings, there seems to be a lack of knowledge of AI despite the fact that this technology surrounds us in a variety of ways. Knowledge of AI and the ability to critically evaluate its effects and benefit from it on a level that matches the needs of the knowledge society are crucial in our globalising working lives [24]. In their diaries, the students reflected on their previous knowledge and what they had learnt during the course. They revealed that they knew next to nothing about AI before the workshops and that they felt much more comfortable and confident about the topic afterwards. For them, the most important issues were the need for AI literacy in today’s society, the moral dilemma of using AI and the basics of machine learning. Even though the topic of AI’s history was covered during the classes, few participants were interested in it. However, we feel that it is important to offer this background information to students.

Implications of the study

The implications of these results are that online workshops based on our instructional design can effectively enhance AI literacy and the comprehension of AI-related concepts among university students, even those with minimal or no coding experience. To make our workshops
interactive, constructive and reflective, we adopted the flipped classroom approach, incorporated various class activities and post-lesson reflection (please refer to Section 2.3 for more details). These features promoted the mutual interactions among the workshop participants as well as their engagement with the workshop contents, contributing to the positive outcomes of these workshops. Furthermore, different educational or cultural backgrounds do not necessarily impede positive learning results. On the contrary, the students in this study felt that they learned also cross-cultural communication, even if it was not the topic of the workshops. Our findings contribute to the demystification of AI and may be important in overcoming the concern that this technology is a complex topic that always requires programming experience. This may help students to develop an informed view of AI’s potential in their lives and society more generally.

Strengths, limitations and future research

The mixed-methods convergent parallel design adopted in this study proved to be very helpful. The combination of quantitative pre- and post-workshop surveys and qualitative learning diaries allowed us to view the findings from the perspectives of learning achievements and students’ experiences. However, some limitations remain. The mixed-methods convergent parallel design poses a challenge as the qualitative data and the quantitative variables offer different angles, which may be open to dissimilar interpretations [11]. Another shortcoming is that the quantitative and qualitative samples have slightly different sizes [11]. The number of participants was small, and the students had very diverse backgrounds geographically. However, although the group was not homogeneous, their thoughts and experiences exhibited consistency, which is why we offer the above recommendations. We believe that future longitudinal studies conducted in similarly diverse international contexts will produce new interesting insights into our globalising multicultural world. Furthermore, teachers should be aware of the challenges of working on AI literacy. As AI is an abstract topic, the use of practical examples and demonstrations is important to link instruction to students’ everyday lives and future careers. Researchers and practitioners could develop an AI-literacy inventory to keep pace with the rapid growth of the technology and facilitate the exploration of how it influences students’ learning and whole-person development. Our surveys could also be refined to better comprehend the effectiveness of the AI module in the course. Follow-up interviews with students are planned for the fall of 2023 to gain a more comprehensive understanding of the topic and allow us to improve the course.

Regarding future research, exploring the scalability and adaptability of our online workshops to diverse student populations and educational contexts could provide valuable insights into the topic in question. Moreover, improving the sample with different groups of participants and instruments could provide more generalisable findings and contribute to a more thorough understanding of the workshops’ impact.

Conclusions

Governments worldwide are implementing policies to incorporate AI into the curricula of their higher education systems, which signals its essential role in learning. Teacher education plays a crucial role in equipping pre-service teachers with the necessary AI literacy to comprehend and effectively utilise AI applications as well as critically reflect on their ethical deployment in their future working lives.

We designed online workshops for international university students with little or no prior knowledge of coding and AI in order to develop their AI literacy and a deeper understanding of related concepts. We tested their knowledge before and after the workshops and asked them to reflect on their learning. Thus, we discovered that the participants became more confident about the topic and that prior knowledge of programming was not necessary to foster AI literacy. The students explained that they had realised the importance of having an informed opinion on the ethical use of AI and of teaching it in their future careers. The flipped-learning approach with pre-class readings was challenging; however, its purpose was understood during the workshops. According to the participants’ opinions, interactivity and collaborative working in international groups supported the learning of a difficult topic such as AI as well as cross-cultural communication.

We designed this course as part of a collaborative international project in higher education that involved joint curriculum development, shared teaching and staff exchange. This design provided practical internationalisation and knowledge transfer. We fully recommend benefiting from similar possibilities to cooperate and learn with and from one another. As part of this curriculum, we hope to create permanent, widespread international collaborations in order to enable more students to improve their cross-cultural communication skills and advance their knowledge of AI and its uses.

CRediT authorship contribution statement

Satu-Maariit Korte: Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. William Man-Yin Cheung: Writing – review & editing, Writing – original draft, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. Mari Maasilta: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. Siu-Cheung Kong: Writing – original draft, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization. Piggja Keskitalo: Writing – original draft, Conceptualization. Lixun Wang: Writing – original draft, Conceptualization. Chaak Ming Lau: Writing – original draft, Conceptualization. John Chi Kin Lee: Funding acquisition, Supervision, Writing – original draft, Conceptualization. Michelle Mingyue Gu: Writing – original draft, Supervision, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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