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ABSTRACT

This study looks at how attending an AI literacy course affects university students' AI literacy level and their sense of empowerment in a one-group quasi-experimental pre-test and post-test study design, using an AI literacy and empowerment pre-test and post-test, and aims to understand the impact of attending an AI literacy program (220 undergraduate students from the preparatory year at King Faisal University, studying a range of disciplines, with only a short introduction to the basics of AI). The study involved teaching basic AI (concepts, chosen educational applications, discussing ethical issues, and practical AI use in their studies) using an AI literacy and empowerment assessment by applying an AI literacy post-test and an AI empowerment post-test that were verified for results. The study shows a statistically significant improvement in both AI literacy and students' empowerment levels in a range of different settings, where AI literacy could make a tangible difference. Therefore, this study makes an important contribution to the discussion of what it means to be a sustainable education system for university students in the AI era. It also suggests that this study could inform universities and policymakers about what steps need to be taken to ensure AI initiatives are practical, ethically sound, and support the learning needs of students.

Contribution/Originality: This study contributes to the existing literature by examining how a short, structured AI literacy course influences both AI literacy and empowerment among preparatory-year university students. It is one of very few studies investigating these outcomes simultaneously while documenting measurable gains in knowledge, skills, confidence, and responsible AI use among students.

1. INTRODUCTION

AI is pervasive. It has now entered many other areas, not only administrative but also social, economic, educational, and other aspects of life. Moreover, AI provides a useful tool in various aspects of education, including teaching, learning, assessment, feedback, and access to learning resources. This has prompted academics to look towards how it can be beneficial in the sector and how they can ensure that students are prepared to use such tools appropriately in their studies (Adeshola & Adepoju, 2024).

Generally, AI refers mainly to computer programs with the ability to perform tasks typically associated with human intelligence, allowing the systems to learn from data to recognize patterns, interpret language, make predictions, and support decision-making (Lo, 2023; Rahman & Watanobe, 2023). In education, such capacities are utilized in, but not restricted to, adaptive learning approaches, intelligent tutoring, automated feedback, learning analytics, and AI-supported writing or investigative tools. This would further ensure that students from poor and disadvantaged backgrounds get individualized support that teachers and parents might not have given their children

due to unavailability (Montenegro-Rueda, Fernández-Cerero, Fernández-Batanero, & López-Meneses, 2023; Sok & Heng, 2023).

Whilst the availability of AI tools has rapidly expanded, students may not be prepared to make good use of them; they may accept AI-generated information without evaluating its truthfulness, fairness or relevance but may not be mindful of such things as algorithmic bias, issues of privacy, misinformation, academic integrity and appropriate ethical limits on their use of AI. For these reasons, the full educational value of AI depends not just on students having access to AI tools, but on their being able to understand, question and use these tools responsibly. This points to the need for AI literacy in higher education. AI literacy involves understanding the basic concepts of AI, along with its capabilities and limitations, evaluating the outputs of AI, and assessing AI's societal and ethical impacts. For a university student, these things are important, both for their higher education, for their future employment purposes, and in their capacity as ordinary but responsible citizens.

Despite previous research on the application of AI in higher education and the urgent need for students to obtain skills in AI literacy, there is a need for empirical evidence about the specific impact of structured intervention initiatives within this domain, especially short programs that are carefully planned to enhance comprehension of AI and increase levels of confidence in critically and responsibly using artificial intelligence technologies among students. This addresses an important gap for tertiary institutions striving to carry out practical solutions for AI literacy in undergraduate study. Thus, this study examines what effect an AI literacy intervention has on university students' AI literacy and perceived empowerment, focusing on preparatory-year students at King Faisal University (KFU) in a one-group pre-test–post-test design before and following such intervention, and exploring its contribution to present debates around sustainable education to educate them in AI-assisted teaching and learning environments.

2. LITERATURE REVIEW

2.1. AI Literacy Courses

The advent of AI in learning, assessment, writing, information retrieval, feedback, and career preparation has caused emphasis to shift from merely providing easy access to AI tools toward developing the competencies required to use them critically and responsibly. In this sense, AI literacy encompasses knowing the basics about machines, where machines are used, how to use tools correctly, how their output can be evaluated, how to communicate with them, and how to consider the ethical and social consequences of those tools, not just having enough technical knowledge to use them or know what an app can perform. Early competency frameworks identified students' ability to differentiate, understand, use, and evaluate AI's performance (Almatrafi, Johri, & Lee, 2024; Laupichler, Aster, Schirch, & Raupach, 2022; Long & Magerko, 2020; Ng, Leung, Chu, & Qiao, 2021). Recent overviews also consider ethical participation, skills related to human-AI cooperation, and informed decision-making as important for that role.

Most recent frameworks consider AI literacy an integration of technical, practical, critical, ethical, and sociocultural competencies (Chiu, Ahmad, Ismailov, & Sanusi, 2024; Stolpe & Hallström, 2024). Within higher education, the multidimensional perspective on AI literacy encourages whole-institutional approaches where it is infused into academic study and not restricted to computer science programmes (Southworth et al., 2023; Zhou & Schofield, 2024).

The growth in the quantity of AI literacy research has also delivered tools to work out about students' familiarity and confidence with AI. Hornberger's team developed a test on university students' AI familiarity. Further tools have assessed different combinations related to AI knowledge, proficiency, competence, behaviour, and attitudes, which include the Meta AI Literacy Scale by Carolus's team and the Artificial Intelligence Literacy Scale developed by Wang, Rau, and Yuan (2023). Nevertheless, in Lintner's systematic review, significant differences have been identified in such areas as which aspects related to AI literacy are covered in each instrument, and in which manner and to what extent, in relation to scientific quality and methods, the instruments' development results in that aspect as part of AI literacy and attitude towards that field of study being assessed (Lintner, 2024). Such differences suggest that

conclusions as to students' AI proficiency can differ partly, depending on their construction and measurement scale based on the instrument that is selected to assess those skills.

Data from the university population corroborate the idea that training in the field of AI proficiency needs intervention. Lee and his staff found that some students at the university had gained previous exposure to training methods related to AI proficiency, as they were more likely to provide correct answers on basic subjects of the topic (Lee, Oh, & Hong, 2024). The paper revealed, however, the fact that exposure due to day-to-day tasks that involve the use of the system was far from a satisfactory and effective way of teaching students how this particular system works and what concepts should be developed first to have a more sophisticated outlook on it. A multinational assessment completed with students in Germany, the United Kingdom, and the United States also disclosed the inconsistencies associated with AI proficiency, confidence, attitudes, and previous experiences in training (Hornberger, Bewersdorff, Schiff, & Nerdel, 2025). Regular use of tools can cause students' comprehension and critique of the topic to fail, along with their sense of ethics related to it. That is why universities cannot assume that students acquire acceptable AI proficiency through the use of everyday tools alone without structured training.

The effects AI proficiency development can have may therefore only occur under research circumstances through intervention by giving training related to AI. Kong and his team reviewed an AI proficiency test provided on this subject that helps in developing university students' conceptual comprehension, proficiency, and empowerment towards the field (Kong, Cheung, & Zhang, 2022). The result implies that structured instruction aids students in getting acquainted with basic concepts and becoming able to engage in AI. The finding could relate to students with diverse backgrounds due to the implications according to which instructions concerning AI literacy should not be limited to those with backgrounds in programming or computing.

In different forms, other higher education initiatives reached similar conclusions. A mixed-method study across graduate-level courses found that combining human collaboration, generative AI tools, guided activity, and critical reflection could empower students' AI literacy (Tzirides et al., 2024). As for medical education, students were rendered readier for interaction with different AI applications in medical imaging after a flipped-classroom intervention that combined self-directed material and interactive sections (Laupichler et al., 2022).

Perchik et al. (2023) revealed the value of a multi-institutional infrastructure in which AI concepts could be embedded into medical education and radiological education. In chemistry education, critical reflections of students upon chatbot responses were employed by Young, Dawood, and Lewis (2024) to support the advancement of AI literacy. These studies support the idea that AI literacy-related courses appear most meaningful when general concepts are linked with decisions, authentic outputs, and limitations of AI-generated information in specific subjects.

Instructional design is as significant to AI literacy programmes as the topics included in this kind of course design. Active approaches provide students with access to investigating how AI systems operate, applying AI to distinct problems, comparing decisions by humans and machines, and reflecting on the consequences arising from the use of AI. For instance, Lee, Ali, Zhang, DiPaola, and Breazeal (2021) joined technical concepts with ethical discussion and career exploration within a curriculum for developing learners as AI users and AI citizens. The programme was carried out with students but reveals the value of integrating technical knowledge with social and ethical questions for people.

The result of an also related systematic survey carried out by Casal-Otero et al. (2023) indicated that project-based learning, problem-solving, collaborative inquiries, discussion, and reflection could assist with embedded AI literacy. Approaches that go beyond passive presentation of the definitions or uses of AI require students to practice concepts, estimate outcomes, and take into consideration wider implications derived from the use of AI.

Regardless of the fact that some pedagogical studies were carried out in school environments, the design can be helpful with regard to general courses at university for students without much technical experience. Concepts such as AI literacy can be revealed through practical tasks, concrete cases in point, argumentation, and ethical analysis in a manner that does not necessarily require any advance in programming. This is likely an important point as regards

the case of pupils during a preparatory year, as they start university perhaps having inconsistent educational experiences and varying levels of prior exposure.

Related research also derives the same conclusions within teacher education. The study discovered previously that the addition of AI literacy lessons within a course that incorporates technology increased the students' perceptions, including their conviction, mainly among those with little education (2025). Research found earlier that a professional-development programme using instructional methods improved student teachers' literacy about AI. Nevertheless, upon surveying a large range of aspects, Sperling et al. (2024) found that AI literacy was understood unevenly in teacher education and that the curriculum did not include enough content on technical, ideological, analytical, and moral aspects (2024). Findings support structured instruction while urging that the teaching of artificial intelligence literacy should not remain confined to students concentrating in computing, construction, or courses related to technical education.

There are certain further requirements for AI literacy education brought about by the rapid growth of generative AI-related matters. University students not only have to understand the construction of prompts, but also review prompts for prompt verification. They also have to understand bias, verification, writing, and how proof can impact the material generated through AI. Chen, Tallant, and Selig (2025) found that students found the use of generative AI valuable for improving productivity and learning, but they still remained worried about verification, reliability, and proper use of generative AI. Along similar lines, in the case of university students, O'Dea, Ng, O'Dea, and Shkuratskyy (2026), who explored generative AI-related literacy, noted that factors, i.e., previous education, subjects of education, and institutional and environmental factors, could have an impact.

This argues against the idea that students with positive feelings about AI or those who frequently use AI are necessarily more critically skilled. Knoth, Tolzin, Janson, and Leimeister (2024) concluded that competence in prompt use requires deeper AI literacy, including understanding system constraints for improved results and the ability to analyse responses and adapt interaction strategies. Prompting for effective utilisation means teaching engineering as part of continuous learning and AI consideration, not as a standalone skill.

Feeling capable of using the tool and being motivated to learn more, rather than being afraid of its impact, has also been connected to increased learning motivation. Kong and Yang (2025) used 'impact, self-efficacy, creative efficacy and meaningfulness' as the four parts of their Artificial Intelligence Empowerment in their work to define a scale and identify the effects of an AI literacy programme as an independent educational outcome.

Using similar categories and measuring scales (academic-level rather than employment-oriented assessment, as they did), Bećirović, Polz, and Tinkel (2025) also linked basic AI literacy, technical understanding and practical knowledge to improve competence, with increased self-efficacy in AI among university students, with findings supporting (Wut, Chan, Wong, & Chan, 2025). AI empowerment should be explored as an effect of literacy, not assumed with increased AI knowledge, as findings from this line of work seem to support.

Literary forms range from conceptual frameworks and scales for measuring competence to cross-sectional surveys/discipline-specific courses or evaluations of the effectiveness of intervention programmes. They suggest a positive impact in all aspects studied: conceptual knowledge; ethics and responsible use; practical training or self-efficacy; confidence, motivation, and empowerment through learning literacy rather than only skill acquisition. Findings show that, while general courses in AI tend to be implemented during later years of study, they focus less on critical evaluation as part of training for professionals in that field. However, there is a scarcity of studies that aim to understand whether this effect has a similar impact on preparatory students and whether this short study would improve both literacy and perceived empowerment, despite the varied academic backgrounds of this stage group in higher education. In these settings, the adoption of certain priorities and previous experiences with education through different languages and culture-based factors will require further exploration, even at the institutional rather than national level. This will shed light on whether this effect is generalisable across settings, especially since no significant

amount of research has surfaced within contexts such as Saudi Arabia or, to a great extent, the Middle East, in the recent past or present literature.

In our study, we report the effect of a four-day AI literacy intervention among first-year university students from King Faisal University. By considering both levels separately: AI literacy training combining traditional instructions, such as presentation of concepts, with use-based instructions: use for different purposes (such as problem-solving) and evaluation activities with hands-on practice sessions; as well as student discussion or participation, peer teaching, or creativity, for example, case analysis, brainstorming, scenario design, etc. In parallel, the same group is investigated to understand if students can see themselves as empowered after having taken such training, with effects varying according to the types and amount (number of training days) of training activities or pedagogical approaches used along various conceptual or domain-focused lessons. With results on self-efficacy, for example, as measured by surveys taken by pupils; motivation to engage with future learning; attitudes towards learning, as captured by feedback sheets they provide; and possibly a mixture thereof for future training sessions designed for a particular year of higher education, to effectively prepare future members of society for a society and workplaces increasingly influenced by AI. This is an issue addressed by means of providing further study into it, so we would explore its impact combined with literacy: does it make their learning experience better compared with regular lessons in terms not only academically but socially as well, and by developing their awareness so that these gains are more informed?

3. METHODOLOGY

3.1. Research Questions and Hypotheses

The main objective of the research is to measure the effectiveness of AI literacy programs in fostering AI literacy and AI empowerment among university students. This can be addressed by answering the following questions:

Main question:

To what extent do AI literacy programs foster literacy and empowerment among university students?

Sub-questions:

What is the impact of AI literacy programs on university students' literacy?

What is the impact of AI literacy programs on university students' empowerment?

Hypotheses:

There are statistically significant differences (at the 0.05 level) between the pre-test and post-test mean scores of university students on the AI literacy scale, with higher scores in the post-test, attributable to the AI literacy program.

There are statistically significant differences (at the 0.05 level) between university students' pre-test and post-test mean scores on the AI empowerment scale, with higher post-test scores attributable to the AI literacy program.

3.2. Design

The study had a one -group quasi-experimental pre-test/post-test design since it aimed to measure changes in AI literacy and empowerment before and after participation in an AI literacy intervention. No control group was used; thus, we interpreted the changes found as being associated with participation rather than as a causal effect in itself.

3.3. Sample Selection and Demographics

The data were collected from 237 preparatory-year students attending King Faisal University in the academic year 2023–2024 through email invitations sent to them by the university registrar. However, some of those students had prior knowledge/AI literacy and were excluded/screened from participation, reducing the number of samples to 220 students between 18 and 20 years. Females represented 59%, and males 41%, which is representative of the overall gender distribution in the preparatory year for the academic year 2023–2024. All participants willingly consented to get involved before data collection began.

3.4. Intervention

The AI literacy intervention consisted of face-to-face sessions over two weeks, comprising four full training days. Two training days were organized weekly, with students attending two sessions each day. The sessions lasted from 30 to 90 minutes. A twenty-minute break was provided between sessions. The intervention sessions focused on introducing students to a basic understanding of AI concepts, some educational uses of AI, and ethical issues connected with AI use, with practical activities to support students in applying AI tools in responsible and useful ways. Methods of teaching and learning used included short lectures, brainstorming activities, class discussions, peer discussions, including peer teaching, and several problem-based exercises.

A detailed breakdown of session topics, durations, and instructional methods is provided in Table 1.

Table 1. AI literacy course outline.

Day 1				
Module	Topics	Delivery	Duration	Materials
Introduction to the course	- Getting to know each other and breaking the ice. - Application of the data collection tools (pre-assessment)	-	30 minutes	- Slides - Online surveys
Introduction to AI	- What is AI? - Definition, history, and evolution of AI. - Types of AI: Narrow AI, General AI, and Superintelligence. - AI in Everyday Life - Real-world applications (e.g., healthcare, education, entertainment). - Addressing common misconceptions about AI. - Q&A / Discussion: Have you used AI today? (Quick poll) - For what purpose?	- Lecture - Discussion - Quick poll	90 minutes	- Handouts - Videos - Slides - Quick poll (Poll Everywhere)
Break		20 minutes		
Foundational Concepts in AI	- Key AI Technologies: Machine Learning (ML), Deep Learning, Natural Language Processing (NLP), Computer Vision. - How AI Works. - Basics of algorithms, data, and models. - Supervised, unsupervised, and reinforcement learning. - Q&A / Discussion: How does social media use AI to personalize ads and recommendations?	- Lecture - Discussion	90 minutes	- Handouts - Videos - Slides - Recommended home reading: Artificial Intelligence in Education: A Methodological Review (in Arabic)
Day 2				
Module	Topics	Delivery	Duration	Materials
AI Tools and Platforms	- Introduction to tools like Google Teachable Machine. - No-Code/Low-Code AI Platforms (Google AI). - AI in Everyday Tools: Using AI-powered tools like ChatGPT.	- Lecture - Peer Teaching - Discussion	60 minutes	- Handouts - Videos - Slides
Break		20 minutes		

Critical Thinking and AI Literacy	- Understanding AI Bias: How bias enters AI systems and its societal implications. - Evaluating AI Systems: How to assess the reliability, fairness, and transparency of AI tools? - Recognizing deepfakes, AI-generated content, and misinformation. - Q&A / Discussion related to the home reading: - How can education use AI to enforce learning outcomes?	- Lecture - Discussion - Problem solving	90 minutes	- Handouts - Videos - Slides - Real AI system examples to detect bias and deepfake misuse. - Recommended home reading: - The impact of artificial intelligence on reducing the cost of modern construction (in Arabic)
Day 3				
Module	Topics	Delivery	Duration	Materials
Ethical and Social Implications of AI	- AI Ethics: Privacy, surveillance, and data security. - Ethical dilemmas in AI development and deployment. - AI and Society: Impact on jobs, economy, and inequality.	- Lecture - Discussion - Brainstorming in groups	60 minutes	- Handouts - Videos - Slides
Break		20 minutes		
AI Empowerment and Future Readiness	- AI in Careers: How AI is transforming various industries and career paths. - Skills needed for AI-related jobs. - Lifelong Learning in AI: Staying updated with AI advancements. - Resources for continuous learning (e.g., MOOCs, research papers). - Q&A / Discussion related to the home reading: - How can the modern construction industry use AI effectively?	- Lecture - Discussion - Brainstorming in groups	90 minutes	- Handouts - Videos - Slides - Recommended home reading: - Artificial Intelligence and the Sports Industry (in Arabic)
Day 4				
Module	Topics	Delivery	Duration	Materials
Practical Applications	- AI in Action: Case studies of successful AI implementations. - Debate activity: - Who is responsible when AI makes a harmful decision? - Will AI replace jobs, or create better ones?	- Lecture - Discussion - Brainstorming in groups	60 minutes	- Handouts - Videos - Slides - Quick poll (Poll Everywhere)
Break		20 minutes		
Assessment and Feedback	- Conclusion of the course. - Application of the data collection tools (post-assessment).	-	40 minutes	- Slides - Online surveys

3.5. Technique and Instruments

The study employed two scales: AI literacy and AI empowerment, as follows:

1. AI literacy

To answer the second research question, the AI literacy scale by Carolus, Koch, Straka, Latoschik, and Wienrich (2023) was used. This scale consists of 34 self-assessment items (Table 2). It uses a ten-point Likert scale ranging from 0 = hardly pronounced to 10 = perfectly pronounced. The scores on the scale ranged from 0 to 340.

Table 2. AI literacy scale.

N	Item
1	I can operate AI applications.
2	I can use AI applications to make my life easier.
3	I can use artificial intelligence meaningfully to achieve my goals.
4	I can interact with AI in a way that makes my tasks easier.
5	I can work together gainfully with artificial intelligence.
6	I can communicate gainfully with artificial intelligence.
7	I know the most important concepts of the topic "artificial intelligence".
8	I know definitions of artificial intelligence.
9	I can assess what the limitations and opportunities of using AI are.
10	I can assess what advantages and disadvantages the use of artificial intelligence entails.
11	I can think of new uses for AI.
12	I can imagine possible future uses of AI.
13	I can tell if I am dealing with an application based on artificial intelligence.
14	I can distinguish devices that use AI from devices that do not.
15	I can distinguish if I interact with an AI or a "real human".
16	I can weigh the consequences of using AI for society.
17	I can incorporate ethical considerations when deciding whether to use data provided by an AI.
18	I can analyze AI-based applications for their ethical implications.
19	I can design new AI applications.
20	I can program new applications in the field of "artificial intelligence".
21	I can develop new AI applications.
22	I can select useful tools (e.g., frameworks, programming languages) to program an AI.
23	I can rely on my skills in difficult situations when using AI.
24	I can handle most problems in dealing with artificial intelligence well on my own.
25	I can also usually solve strenuous and complicated tasks when working with artificial intelligence well.
26	Despite the rapid changes in the field of artificial intelligence, I can always keep up to date.
27	I can keep up with the latest innovations in AI applications.
28	Although there are often new AI applications, I manage too always be "up-to-date".
29	I don't let AI influence me in my decisions.
30	I can prevent an AI from influencing me in my decisions.
31	I realize if artificial intelligence is influencing me in my decisions.
32	I keep control over feelings like frustration and anxiety while doing things with AI.
33	I can handle it when interactions with AI frustrate or frighten me.
34	I can control my euphoria that arises when I use artificial intelligence for different purposes.

2. AI empowerment

To answer the third research question that measures students' empowerment in relation to AI literacy, the AI Empowerment instrument developed by Kong and Yang (2025) was used. This scale consists of 16 self-assessment items (Table 3) distributed through four components, namely Impact, AI self-efficacy, Creative self-efficacy, and Meaningfulness. The scale uses a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. The scores on the scale ranged from 16 to 80.

Table 3. AI empowerment scale.

N	Item
1	I want to apply my AI knowledge and skills to solve problems in daily life.
2	I want to solve problems with AI to make people's lives better.
3	I want to solve problems with AI to make daily life easier.
4	I want to apply my AI knowledge and skills to develop interesting solutions to problems.
5	I can learn to be better at solving problems with AI.
6	I am good at solving problems with AI.
7	I think of myself as someone who can solve problems with AI.
8	I have the knowledge and skills to solve problems with AI.
9	I have confidence in my ability to solve problems with AI.
10	I can think creatively when I use AI to solve problems.
11	Solving problems with AI allows me to be creative.

N	Item
12	I like to express my ideas through solving problems with AI.
13	Using AI to solve problems will help me achieve my goals.
14	I want to be good at solving problems with AI.
15	Using AI to solve problems is important to me.
16	Using AI to solve problems is useful to me.

3.6. Data Collection and Process

Before the intervention began, the researcher met with the participants to explain the purpose of the course, its expected learning outcomes, and the AI-related competencies they were expected to develop. The meeting also aimed to encourage students' commitment to the training activities and clarify how they would access the course materials through the Moodle platform.

Before the start of the training, participants completed the AI literacy and AI empowerment pre-assessments. The intervention was then implemented over approximately two weeks, from 04/08/2024 to 15/08/2024. After the intervention was completed, the same AI literacy and AI empowerment instruments were administered as post-assessments.

The data obtained from the pre- and post-assessments were analyzed using paired-samples t-tests. This analysis was used to determine whether there were statistically significant differences in students' AI literacy and empowerment scores after participating in the intervention.

4. DATA ANALYSIS AND RESULTS

Paired-samples t-tests were used to test whether students' AI literacy and AI empowerment scores changed after taking part in the intervention by comparing participants' pre-test and post-test scores for each scale. Statistical significance was evaluated at the 0.05 level. Besides p-values, Cohen (1988) dz and 95% confidence intervals for the mean difference were reported to provide an indication of the practical magnitude, together with the precision of the given changes.

4.1. AI Literacy

Firstly, a paired-samples t-test for comparing students' AI literacy scores before and after the training intervention, with an independent t-test for comparing students' AI literacy scores, was carried out to test the first hypothesis that students' AI literacy scores would be improved by the intervention. As clearly shown in Table 4, the mean AI literacy scores increased from 231.83 (SD=61.16) at pre-test to 242.35 (SD=62.28) at post-test, with a mean difference of 10.52. This is supported by the 95% confidence interval for the mean difference, from 9.55 to 11.49, together with a large effect size, whereby its Cohen (1988) $dz = 1.44$, and a statistically significant increase, with results of $t(219) = 21.34$, $p < .001$. All these findings therefore showed that the intervention was successful in improving students' AI literacy scores, so the first hypothesis was strongly supported.

Table 4. Paired sample t-test of AI literacy.

Scale application	N	Mean	SD	df	T	Sig.	95% CI
Pre-test	220	231.83	61.16	219	21.34	0.000	9.55, 11.49
Post-test	220	242.35	62.28				

4.2. AI Empowerment

The second hypothesis concerned students' AI empowerment. A paired-samples t-test compared empowerment pre- and post-intervention. As Table 5 shows, the mean empowerment score increased from 55.40 (SD = 11.84) at pre-test to 64.24 (SD = 11.99) at post-test, for an 8.84-point mean increase. The increase was statistically significant,

$t(219) = 17.84$, $p < .001$, 95% CI $[-7.86, 9.82]$, Cohen's $d_z = 1.20$, large effect. This indicates that students felt more empowered after completing the AI literacy intervention. The second hypothesis was therefore supported.

Table 5. Paired sample t-test of AI empowerment.

Scale application	N	Mean	SD	df	t	Sig.	95% CI
Pre-test	220	55.40	11.84	219	17.84	0.000	7.86, 9.82
Post-test	220	64.24	11.99				

5. DISCUSSION

The results suggest that there was a marked improvement in students' AI literacy, alongside their perceived empowerment as a result of the AI literacy intervention. The AI literacy scores showed a significant improvement from pre-test to post-test scores, indicating that the intervention had helped the students gain a clearer understanding of fundamental concepts of AI, its applications in education, its ethical issues, and practical tools and their use within AI. The results were in accord with work done in the field (Hur, 2025; Kong et al., 2022; Ng, Leung, Chu, & Qiao, 2021; Su, Ng, & Chu, 2023), where the results demonstrated a clearer understanding of AI-related literacy.

One of the potential reasons for the improvement in AI literacy levels for the students was down to how the intervention was designed: it did not solely rely on lecture-based instruction and instead used elements of discussion, peer teaching, brainstorming, and problem-solving to enable the students to tie specific AI concepts within a realistic and practical situation and be enabled to critically appraise how the specific tools may be used to aid their learning. As AI literacy requires not just being aware of the tools on offer, but evaluating AI outputs, assessing boundaries/limitations, as well as making ethical judgments on their use, it was therefore clear that through the intervention both a stronger understanding of the key concepts and an ability to critically judge AI outputs and tools came into practice for the individual students.

The results also showed increasing confidence in AI. This suggests that students felt more resilient or empowered when grasping and applying AI after completing the intervention. Increasing student empowerment in what is a relatively new and intimidating field for some is vital: students may come across different AI utilities professionally, socially, and academically and not feel empowered enough to use them ethically or with full responsibility at best. The finding is generally corroborated by those that marry AI literacy and self-efficacy (Lee et al., 2021), ethical awareness and confidence of engaging with AI (Casal-Otero et al., 2023), or informed participation in AI-supported environments (Xiao et al., 2024).

The rapport between AI literacy and student empowerment is likely one of the main implications of this study. The notion is that when students become more knowledgeable about AI ideas and applications, they may also feel more enabled to question, analyze, and exploit AI more ethically and proactively, instead of approaching it passively. Addressing the ethical aspects of AI applications in the real world in the intervention may partially explain the improvement in student empowerment. The course not only exposed students to AI as a piece of technology without any other input but also put AI in critical thinking, responsibility, and its use in an educational environment rather than something that must be accepted, empowering them to think about how AI can be evaluated and used thoughtfully. This view suggests that AI literacy programs should aim to combine skill development with activities to critically reflect on ethical considerations and opportunities to understand consequences of AI use in authentic situations.

Furthermore, the findings bear on decisions and recommendations about how to integrate AI in higher education. Higher-level decision-makers should not assume that providing access to AI tools translates immediately or inevitably into competent and responsible use. Findings from this current research suggest that students benefit from activities to grasp how to appropriately use AI in teaching and learning. The integration of AI education within

university curricula would support the confident and reflective use of AI as an asset for higher education, as AI is becoming a more noticeable asset in students' academic journeys and future professional fields of work.

Limitations: These results must be interpreted within the context of the study design; for instance, the one-group pre-test/post-test design does not allow us to assume that changes after the intervention were caused by the course alone. Other factors may include testing effects or opportunities during this time when students were exposed to other forms of engagement with AI. Future studies could be undertaken using comparison groups and additionally could include delayed post-testing and qualitative evidence, such as interviews and reflective journals, to explore whether changes are sustained and whether, and how, students apply AI literacy and empowerment in practical contexts.

6. CONCLUSION

This study focused on whether students improve AI literacy and perceived empowerment after a structured AI literacy intervention. The post-test results were significant, as improvement was seen in both of these in comparison to the pre-test scores. This means that students showed an understanding of AI concepts, their applications, ethical issues, and their responsible usage after the workshop. It can also be seen that AI literacy can be improved if course content is conceptually, practically, and ethically discussed; if taught thoroughly, through this, a noticeable change can be seen in the improvement of empowerment in all these. Improvement in empowerment in individuals may improve their judgments in recognizing limitations and using these tools in such a way that both their working, learning, and professions can improve and perform optimally.

This study adds to the debate on sustainable education by showing how AI literacy can help prepare students for a learning environment that is increasingly shaped by digital technologies. For universities, the suggestions are that AI literacy should be built into curriculum developments, into student support, and into the broader digital competence strategies of universities today. Future work will need to build on these findings by including comparison groups, a lengthier follow-up period, and qualitative evidence for how students apply AI literacy after their immediate engagement with an intervention.

7. RECOMMENDATIONS

My recommendations in relation to this project are that, rather than relying on short, optional AI literacy workshops, it is advisable for universities to look at ways to embed AI literacy into existing courses. AI literacy content could be tailored to different disciplines by, for example, addressing ethical and societal AI implications in social science courses or, with writing and research methods courses, building it around guided activities on evaluating AI-generated content and responsibly using different AI tools. I also suggest that future AI literacy programs could be based on more of an emphasis on practice. Although the intervention did receive positive results, it is likely that a longer program might allow students to be able to complete some short practical projects, reflect on AI use, and obtain direct feedback on their usage of the programs. Project-based assignments and the use of case studies and problem-solving activities could help students to really connect AI concepts with academic and professional applications.

The idea of involving teaching staff represents a primary way of implementing AI literacy. As AI tools and the ethical questions surrounding their use continue to evolve, teaching staff will need help to teach AI literacy confidently and accurately. The university can provide such help through workshops designed to promote professional development, shared teaching materials, assessment rubrics, and examples of discipline-specific AI learning activities. Also, students could benefit from spaces in which they can experiment with AI tools (for a specific discipline) in circumstances that minimize fear of 'getting it wrong' or misusing a tool. Such help systems could prove to be especially useful for those students who arrive at university with a basic knowledge of AI.

8. LIMITATIONS

Several limitations should be considered in interpreting the findings. Firstly, the study applied a one-group quasi-experimental pre- and post-test design without comparison with a control group. Hence, the improvement in students' AI literacy cannot be inferred solely as an exclusive consequence of the training. Testing effects or exposure to other AI-related content might have occurred.

Secondly, the sample was drawn from only one university. Despite the 220 students from different disciplines in the final sample, it is uncertain whether findings represent students in other universities or at other levels of study or in different social and cultural settings. Future studies could include participants from multiple institutions to improve the generalizability of findings. Thirdly, four training days over two weeks is not lengthy. It offers basic development of AI competencies but not deeper issues, including algorithmic bias or more advanced ethical analysis or technical development of AI applications' skills.

Fourthly, the measurements in this study are self-reported. Despite the validated scales, self-report data may be subject to desirability bias or inflated beliefs among students about their own competencies. To provide a much fuller picture of AI literacy, performance-based assessment, classroom observation, interviews, or student artifacts should be used in future research.

Lastly, no delayed post-test was carried out in this study, and thus it remains unknown whether the improvements in AI literacy and empowerment were sustained over time and whether pupils continued to responsibly use and evaluate AI tools.

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