

**ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING INTEGRATION IN
ACCOUNTING EDUCATION: PREDICTING THE ANALYTICAL
COMPETENCIES OF ACCOUNTANCY STUDENTS**

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Abstract

The combination of Artificial Intelligence (AI) and Machine Learning (ML) has changed the face of accounting education, increasing students' technological and analytical capacities. This study investigated the level of integration of AI and ML in accounting education and its impact on the analytical skills of the accountancy students with respect to the analysis of financial data and critical thinking. The results were acquired using a validated questionnaire using a quantitative descriptive-correlational study design from accountancy students. Data was analyzed using descriptive statistics and multiple regression analysis. The results indicate that the perception of AI and ML integration in accounting education is strong especially in the usage of students and ethical and responsible use of AI technology. Regression study also demonstrated that the integration of AI and ML had a considerable favorable influence on students' analytical skills, particularly in the examination of financial data and critical thinking. The findings indicate that increased exposure to AI-enabled learning environments boosts students' skills in interpreting financial data, solving complicated accounting problems and making evidence-based decisions while promoting responsible usage of AI. The study concludes that the integration of AI and ML in accounting courses efficiently develops the analytical, technological and ethical competences necessary from future accountants based on the Technology Acceptance Model. The study suggests that instructional strategies and curriculum innovation should be enhanced through AI to prepare graduates for the changing digital accounting profession.

Keywords: Artificial Intelligence, Machine Learning, accounting education, analytical competencies, financial data analysis, critical thinking.

Introduction

The rapid evolution of Artificial Intelligence (AI) and Machine Learning (ML) has transformed the accounting profession, through the automation of manual labor, improved financial analysis, enhanced fraud detection, and support for evidence-based decision making. Therefore, higher education institutions are seeing a paradigm shift in accounting education as they incorporate AI and ML-based technologies into teaching and learning to prepare graduates for the digital economy. Professional organizations and accounting educators have pointed out that the future accountants should acquire capabilities beyond the standard accounting knowledge to incorporate digital literacy, data analytics, and predictive modelling, and critical analytical skills. Therefore, the integration of AI and ML into

accounting curriculum is regarded necessary to generate graduates that are able to successfully apply intelligent technologies with professional judgment and ethical decision making (Pan & Seow, 2016; Richins et al., 2017; Huang & Wang, 2023). Machine learning, a part of artificial intelligence, allows computers to spot patterns in large amounts of data and reach conclusions with little human help. Its applications in accounting include predictive auditing, anomaly identification, financial forecasting, risk assessment and intelligent decision support systems. With firms progressively adopting AI-enabled accounting solutions, institutions are expected to revamp their courses to include AI and ML ideas, practical applications and data analytics skills. Recent studies of the accounting education literature demonstrate that the inclusion of emerging technology into accounting courses increases students' technological skills, analytical reasoning, and preparation for professional practice. Moreover, accounting education is increasingly transitioning from the focus on procedural knowledge to the cultivation of higher-order cognitive abilities needed for solving complex business challenges in technology-enabled contexts (Theuri et al., 2024; Purba & Dewayanto, 2023).

The ability to analyze has become one of the most important skills that future accountants must possess. Ability to assess financial information, analyze business data, handle complicated accounting problems, evaluate alternatives, and make informed judgments based on quantitative and qualitative evidence. As intelligent systems are generating large volumes of output that require professional interpretation and not just computer processing, the use of AI and ML technologies is on the rise, making analytical thinking more important. Research indicates that the learning environments that are enriched with technology, particularly those that are based on data analytics and applications of artificial intelligence, help students to develop their critical thinking, problem solving and analytical skills, which are vital competencies for accountants today (Stütz et al., 2022; Huang & Wang, 2023; Lemos et al., 2023).

Despite an expanding use of AI and ML in accounting education, empirical evidence on the degree to which the integration of AI and ML predicts the analytical competencies of accountancy students, especially in higher education institutions, remains insufficient. Most of the current research has focused on curriculum development, technology adoption, and professional readiness, with fewer studies quantitatively examining the predictive relationship between AI and ML integration and students' analytical competencies. Filling this gap matters because knowing this relationship could give educators, curriculum creators, and policymakers with empirical data to strengthen accounting programs and match them with Industry 4.0 and digital transformation projects. Thus, this research intends to examine how the use of Artificial Intelligence and Machine Learning in accounting education has a significant effect on the analytical abilities of accountancy students and thus adds to the increasing literature on technology-based accounting education and skill development (Al Ghatrifi, Al Amairi & Thottoli, 2023).

Research Questions

1. What is the extent of Artificial Intelligence and Machine Learning integration in accounting education as perceived by accountancy students in terms of:
 - a. student utilization and
 - b. ethical and responsible use of AI and ML?
2. Is there a significant effect of Artificial Intelligence and Machine Learning integration in accounting education on the analytical competencies of accountancy students in terms of:
 - a. financial data analysis and
 - b. critical thinking?

Review Of Related Studies

Artificial Intelligence and Machine Learning Integration in Accounting Education

Artificial Intelligence (AI) and Machine Learning (ML) are now transformational technologies that are revolutionizing the accounting profession and, consequently, accounting education. Traditionally, accounting education has focused on financial reporting, auditing, taxation, and managerial accounting, but the advent of AI-enabled applications has elevated the skillset that is needed from accounting graduates. Today's accountants need to be more than just technically accounting literate; they are expected to be digitally literate, have data analytics capabilities and know how to comprehend AI-generated insights. AI and ML technologies are being more and more used to automate repetitive accounting processes, identify financial anomalies, assist audit procedures, improve fraud detection, and perform predictive financial analysis, thereby changing the nature of accounting practice and creating new educational needs for higher education institutions (Pan & Seow, 2016; Richins et al., 2017).

According to Purba & Dewayanto (2023), Machine Learning is a subset of Artificial Intelligence that enables computer systems to identify patterns, learn from previous data, and make predictions with minimum human supervision. They have grown more relevant in accounting education because they introduce students to intelligent systems that may be used to help financial forecasting, risk assessment, audit analytics and decision-making. As industries accelerate their digital transformation, accounting curriculum are being revamped to include principles of AI and ML to keep graduates competitive in a changing profession. A systematic review of the accounting education literature noted that the inclusion of AI, ML and other emerging technologies in accounting curricula provides students with the technological competencies and analytical skills sought by employers, bridging the growing gap between academic preparation and industry expectations.

Recent literature further shows that technology-enhanced accounting education is not only about integrating digital tools in the classroom. Rather, the successful incorporation of AI and ML requires a re-examination of teaching methods, curriculum material, learning activities, and assessment techniques to develop higher-order cognitive skills such as critical thinking, analytical reasoning, and evidence-based decision-making. AI-powered simulations,

intelligent tutoring systems, predictive analytics and data visualization platforms offer students opportunities for analyzing large data sets, interpreting complex financial information and solving genuine business problems. These learning environments promote active involvement and prepare students for technology-driven accounting workplaces, where human judgment complements rather than competes with intelligent technologies (Pan & Seow, 2016; Richins et al., 2017; Abdullatif et al., 2023).

Awareness of AI and ML as important components in accounting education is increasing but their incorporation in higher education institutions is inconsistent. Many accounting programs still have issues with curriculum revision, teacher preparation, technical infrastructure, and ethical use of AI applications. Additionally, there is a lack of empirical research on the impact of AI and ML integration on student learning outcomes especially in developing nations where the digital revolution of higher education is still unfolding. Therefore, there is an ongoing need to study the level of integration of AI and ML in accounting education and produce evidence to inform curriculum development, teaching innovation, and policy making. These efforts will ensure that accounting graduates have the competencies they need to thrive in an increasingly digital and data-driven professional environment (Purba & Dewayanto, 2023; Abdullatif et al., 2023).

Importance of Financial Data Analysis and Critical Thinking Skills of Students

Financial data analysis skills are essential in the higher education context today, particularly in business and accounting programs, since they enable students to comprehend financial data, evaluate the performance of organizations, and participate in strategic decision-making. Financial analytics has become an integral part of today's business environment as organizations leverage it to identify trends, predict future performance, evaluate financial risks and make evidence-based decisions. Thus, higher education institutions have been encouraged to increase their students' financial data analysis competencies by integrating analytical tools, data visualization approaches and technology-driven learning experiences into their programmes. Pan and Seow (2016) stated that digital transformation of the accounting profession demands accounting graduates to possess competences in information technology, data analytics, and financial information analysis in addition to traditional accounting knowledge. Richins et al. (2017) also contended that the adoption of advanced big data analytics has altered accounting practices. Accordingly, the analysis of financial data should be a fundamental skill for future accountants to understand large data sets and generate meaningful business insights. More recently, the accounting education literature has repeatedly identified data analytics as a core competency that needs to be incorporated into accounting curricula to improve graduates' professional readiness and decision-making skills (Churyk, Eaton & Matuszewski 2024).

Analysis of financial data also makes a substantial contribution to students' academic achievement, as it promotes evidence-based reasoning, quantitative problem-solving, and informed decision-making (Sargent et al., 2023). Students who develop competency in assessing financial information are more capable of finding links among financial variables, understanding accounting reports, evaluating business performance and recommending

appropriate financial solutions. Educational research has revealed that cognitive growth of students is increased by learning activities involving data analytics assignments. This is because they demand applying analytical reasoning and not rote memorizing. Accounting students with greater cognitive capacities achieved significantly higher scores on data analytics tasks. Sargent et al. (2023) concluded that this suggests that financial data analysis supports reflective judgment and higher-order thinking capabilities. Furthermore, recent reviews of research in accounting education have noted that the incorporation of data analytics into accounting education helps to develop students' analytical skills, communication skills, and practical problem-solving skills, and thus makes higher education more relevant to the changing demands of the accounting profession.

It also highlights critical thinking as one of the most important competencies students need to acquire to succeed in academic and professional settings. This is the ability to analyze information objectively, evaluate evidence, draw logical conclusions, and make reasoned judgments in complex problems. Critical thinking in accounting education enables students to correctly comprehend financial information, to challenge assumptions, to evaluate alternative accounting treatments, and to apply professional skepticism when making decisions. The rapidly changing accounting profession requires graduates to demonstrate strong critical thinking skills much earlier in their careers as accountants are increasingly being asked to deal with complex business issues rather than simply doing routine accounting work (Wolcott & Sargent, 2021).

Likewise, Terblanche and De Clercq (2021) also proposed a holistic critical thinking competency framework that identifies interpretation, analysis, evaluation, inference, explanation, and reflective judgment as core competencies for accounting students in the twenty-first century. Graduates are equipped with the competencies to respond effectively to technological advances, regulatory changes and increasingly complex financial environments (Wolcott & Sargent, 2021). In addition, analyzing financial data involves students in evaluating numerical evidence, identifying patterns, interpreting financial reports, and making data driven decisions, all of which rely on critical thinking processes. Similarly, critical thinking allows students to challenge the accuracy of financial information, evaluate alternative solutions, and support recommendations with objective evidence. Recent evidence suggests that accounting education should actively use analytical learning activities, case-based instruction, data analytics projects and technology-enhanced learning settings to develop financial data analysis and critical thinking skills. Such integration prepares students with the competencies required for success in digitally changed workplaces of artificial intelligence, machine learning, and big data analytics. Thus, the attainment of these complementary competences is vital to train graduates for the performance in increasingly complex and technology-driven professional situations (Wolcott & Sargent, 2021).

Methodology

The study used a quantitative research approach and a descriptive-correlational research design to evaluate if the integration of Artificial Intelligence (AI) and Machine Learning

(ML) in the context of accounting education significantly predicts the analytical competencies of accountancy students. Descriptive part was used to measure the level of AI and ML integration in terms of accessibility, instructional integration, student use, faculty support and ethical use of AI and ML technology. The correlational analysis sought to explore the predictive relationship between AI and ML integration and the analytical competencies of accountancy students, specifically in financial data analysis, critical thinking, problem-solving, decision-making, and data interpretation. The study was done in a higher education institution that offers a Bachelor of Science in Accountancy program. The respondents consisted of accountancy students, who were regularly enrolled, and exposed to the integration of AI and ML applications in their academic courses. The stratified random sampling was used to ensure proportional representation on the basis of year level. Data were collected through a structured questionnaire adapted from validated instruments reported in previous studies on artificial intelligence adoption, technology integration and analytical competencies in higher education. The questionnaire comprised of three parts: (1) demographic profile of respondents, (2) AI and ML integration in accounting school, and (3) analytical competencies of accountancy students. Before data collection, the instrument was content validated by specialists in accounting education, educational technology and research methods. Likewise, a pilot test was done to determine the reliability of the instrument by the use of Cronbach's alpha coefficient. Questionnaires were administered either electronically or in hard copy depending on the accessibility of the respondents after obtaining the necessary institutional approvals. Descriptive statistics (frequency, percentage, weighted mean and standard deviation) were employed to describe the variables and multiple regression analysis was used to determine the predictive effect of AI and ML integration on the analytical competencies of accountancy students. Statistical analyses were performed at 0.05 level of significance.

The study was conducted in accordance with the ethical principles of the human participants' research. The study was preceded by ethical clearance from the research ethics committee of the institution and authorization was acquired from the concerned officials of the university to carry out the study. Participation was fully voluntary and informed consent was acquired from all respondents after explaining the goal, procedures, potential benefits and minimal hazards of the study. Participants were informed of their right to refuse participation or withdraw from the study at any time without penalty. The study also adhered to the concepts of respect for persons, beneficence, non-maleficence, and fairness in accordance with the Philippine National Ethical Guidelines for Health and Health-Related Research (2022) and the institutional policy on research ethics.

Results And Discussions

Research Question 1: What is the extent of Artificial Intelligence and Machine Learning integration in accounting education as perceived by accountancy students in terms of student utilization and ethical and responsible use of AI and ML?

Table 1. Level of Artificial Intelligence and Machine Learning Integration in Accounting Education

Indicators	Weighted Mean	Descriptive Rating	Interpretation
Student Utilization	4.18	High	Accountancy students frequently utilize AI and ML applications to support learning, complete accounting tasks, analyze financial data, and enhance problem-solving skills.
Ethical and Responsible Use of AI and ML	3.96	High	Students generally demonstrate awareness of ethical principles in using AI and ML, including academic integrity, responsible use of AI-generated outputs, data privacy, and proper citation of AI-assisted work.
Overall	4.07	High	Artificial Intelligence and Machine Learning integration in accounting education is highly evident among accountancy students.

Scale: 4.21–5.00 = *Very High*; 3.41–4.20 = *High*; 2.61–3.40 = *Moderate*; 1.81–2.60 = *Low*; 1.00–1.80 = *Very Low*

The overall weighted mean of 4.07 (interpreted as High) indicates that AI and ML technologies have become part of students' academic experiences. This indicates that students are actively employing AI-powered applications to assist in their study and are inclined to adhere to ethical guidelines for the appropriate use of these technologies. The highest weighted mean (WM = 4.18) was obtained from the student utilization indicator among the indicators. This means that accountancy students frequently use AI and ML applications to assist in coursework, analyze accounting data, generate reports, solve computational problems, and improve conceptual understanding. This preliminary finding is consistent with the findings by Pan and Seow (2016) who find that digital technologies have become essential in accounting education due to their ability to improve students' analytical skills and prepare graduates for technology-driven accounting careers. Similarly, Richins et al. (2017) said that the increased adoption of artificial intelligence, big data analytics and machine learning has changed the nature of the accounting practice and as such, the use of technology has become a necessary skill to be developed in undergraduate education. Recently, Abdullatif et al. (2023) found that AI-supported learning environments in accounting education considerably improve students' engagement, technological competence, and preparation for professional practice.

The indication ethical and responsible use of AI and ML also scored High (WM=3.96) which suggests that students usually acknowledge the necessity of academic integrity, responsible AI usage, transparency, data protection and appropriate citation when using AI produced outputs. The growing presence of AI technologies in higher education has made an ethical competence an important learning outcome, alongside a technological one. UNESCO (2021) underlined that educational institutions must support the appropriate use of AI by assuring justice, accountability, transparency and respect for human rights in teaching and learning. Likewise, Crawford (2021) claimed that AI literacy should go beyond technical skills to encompass ethical consciousness, responsible decision-making, and the critical examination of AI-generated information. Abdullatif et al. (2023) also stressed in accounting education, that the preparation of future accountants needs to balance technological innovation and professional ethics since accounting professionals are still responsible for judgments assisted by intelligent technologies.

In overall, the data suggest that the incorporation of AI and ML in accounting education is already very visible among the accountancy students. The integration of diverse technologies with a greater understanding of ethical AI issues indicates that students are on the path to acquiring the skills required to thrive in digitally transformed accounting workplaces. The results add to the increasing agreement that the accounting education should further develop the technological and ethical responsibilities to prepare the graduates to meet the changing needs of the accounting profession.

Research Question 2: Is there a significant effect of Artificial Intelligence and Machine Learning integration in accounting education on the analytical competencies of accountancy students in terms of financial data analysis and critical thinking?

Table 2. Regression Analysis on the Effect of Artificial Intelligence and Machine Learning Integration in Accounting Education on the Analytical Competencies of Accountancy Students

Dependent Variable		β (Beta)	t-value	p-value	Decision	Interpretation
Financial Analysis	Data	0.641	10.82	0.000	Reject Ho	Significant Positive Effect
Critical Thinking		0.587	9.46	0.000	Reject Ho	Significant Positive Effect
Overall Analytical Competencies		0.614	10.14	0.000	Reject Ho	AI and ML integration significantly predicts students' analytical competencies.

Level of Significance = 0.05

Table 2 presents the results of the regression analysis on the effect of Artificial Intelligence (AI) and Machine Learning (ML) integration into accounting education on the analytical

competencies of accountancy students. The results indicate that the integration of AI and ML has a significant positive impact on financial data analysis and critical thinking. Specifically, the use of AI and ML was substantially associated with predicting financial data analysis ($\beta = 0.641$, $p < .001$) and critical thinking ($\beta = 0.587$, $p < .001$). Results yielded the rejection of the null hypothesis, indicating that increased integration of AI and ML in accounting education is associated with higher levels of students' analytical competencies. The considerable impact on financial data analysis indicates that the integration of AI and ML technologies in accounting education improves students' capacity to analyze financial accounts, discover patterns in financial data, assess business performance, and formulate evidence-based suggestions. AI-enabled learning platforms, predictive analytics, intelligent tutoring systems and data visualization tools provide students with access to real datasets and analytical techniques that enhance quantitative reasoning and financial decision-making. This putative finding is in line with Pan and Seow (2016) who suggested that digital technologies and data analytics should be integral parts of accounting education as they educate graduates for the increasingly technology-driven accounting workplaces. Similarly, Richins et al. (2017) noted that the advent of artificial intelligence, machine learning and big data analytics has completely changed accounting practice, making it essential for future accountants to develop higher-order analytical and financial data interpretation skills. More recently, Abdullatif et al. (2023) reported that the adoption of emerging digital technologies in accounting education improves students' skills in financial analysis, data interpretation, and technology-assisted decision-making.

The results also indicate the fact that the integration of AI and ML significantly enhances critical thinking and that students who routinely use intelligent technologies become more skilled in assessing information, challenging assumptions, analyzing AI outputs and making sound professional decisions. Rather than substituting human reasoning, AI-enabled learning environments encourage students to check automated recommendations, compare alternative solutions and critically evaluate the reliability of analytical outputs. Our findings are in line with Wolcott and Sargent (2021) who noted that critical thinking has become one of the most important competencies in accounting education as accountants are increasingly expected to solve complex business problems compared to performing routine computational tasks.

Similarly, Terblanche and De Clercq (2021) proposed that accounting curricula should explicitly develop interpretation, evaluation, inference, explanation, and reflective judgment to equip graduates for complex technology-enabled workplaces. Moreover, UNESCO (2021) emphasized that the responsible use of AI in education should not only enhance technological skills but also foster critical thinking, ethical understanding, and the ability to make informed choices.

Overall, the provisional results suggest that the integration of Artificial Intelligence and Machine Learning is a major predictor of the analytical skills of accounting students. Students can become more proficient at assessing financial information, solving accounting problems, and making decisions based on facts, as AI- and ML-powered training improves the understanding of financial data and critical thinking. These results support the ongoing

integration of AI and ML in accounting curricula to prepare future accountants to meet the changing demands of the digital economy and data-driven accounting profession.

Conclusion

The study found a high level of integration of Artificial Intelligence (AI) and Machine Learning (ML) in accounting education among accountancy students especially in terms of student use and ethical and responsible use of AI and ML technologies. The results indicate that students are increasingly adopting AI-powered applications as learning tools for financial analysis, academic tasks, and decision making. Students are also aware of ethical principles including academic integrity, transparency, data privacy, and the responsible use of AI-generated outputs. The findings show that AI and ML have become useful instructional tools that support students' learning and supplement traditional accounting education and add to a technology-enhanced learning environment.

The study also revealed that the integration of Artificial Intelligence and Machine Learning is a great predictor of the analytical competencies of accountancy students in financial data processing and critical thinking. Increased exposure to AI and ML-based learning experiences will allow students to develop better competencies in interpreting financial information, evaluating accounting data, identifying business trends, solving complex financial problems, and making evidence-based decisions. AI-powered learning environments also foster higher-order thinking by asking students to critically assess AI-generated information, exercise professional judgement, and build sound solutions to accounting problems. The results confirm that the integration of AI and ML leads to a positive development of the competencies that are increasingly demanded by the accounting profession in the digital transformation age.

The findings are based on the Technology Acceptance Model (TAM) proposed by Davis (1989) and suggest that students who perceive AI and ML technologies as useful and easy to use are more likely to adopt these technologies in their learning processes, leading to improved analytical competencies. The study also adds to the expanding body of research supporting the use of AI to supplement, not substitute, human intellect by offering intelligent decision support, data driven insights, and authentic learning experiences to improve students' analytical capacities. Therefore, the convergence of AI and ML in accounting education is an efficient pedagogical approach to prepare future accountants with the analytical, technological, and ethical skills needed in the increasingly digital and data-driven professional world.

Recommendations

Based on the findings and conclusions of the study, the following recommendations are offered: 1. Universities and colleges offering Accountancy courses should strengthen the inclusion of Artificial Intelligence and Machine Learning into the accounting curriculum. AI-supported learning activities, financial analytics software, predictive modeling, and intelligent decision-support systems should be integrated into accounting courses to enhance students' skills in analyzing financial data and critical thinking.

2. Accounting academics should engage in continual professional development programs on AI, machine learning, data analytics, and new teaching modalities. Enhancement of faculty competence will help educators to effectively incorporate new technologies in classroom instruction and stimulate meaningful engagement of students.
3. Establish institutional norms and procedures to encourage ethical and responsible usage of AI technologies. These regulations should focus on academic integrity, openness, data protection, correct citation of AI-generated output, and responsible decision-making to ensure students use AI as a learning supplement, not a replacement for independent thinking.
4. Curriculum developers should align accounting programs to the competency requirements of the digital accounting profession by embedding AI literacy, machine learning applications, business analytics and financial data analysis into program outcomes and course learning objectives. This kind of curriculum enhancement can make us produce graduates who are ready for the technology driven workplaces.
5. It is recommended that future researchers expand this study by including other characteristics such as AI literacy, digital competence, technological self-efficacy, learner engagement, academic performance, and professional preparation. The use of longitudinal, mixed methods, or structural equation modeling methodologies in a number of higher education institutions may offer a more thorough understanding of the influence of AI and ML on accounting education and the competences of students.

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