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Integration of Artificial Intelligence in Teaching and Students' Engagement in Electrical Installation and Maintenance among Grade 10 Students

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Abstract

Aim: This study investigated the integration of Artificial Intelligence (AI) in teaching and its impact on student engagement in Electrical Installation and Maintenance (EIM) among Grade 10 students and teachers at Las Piñas National High School – Almanza for the School Year 2023-2024.

Methodology: Employing a quantitative research design with a descriptive-correlational method, the study utilized total enumeration sampling, encompassing 21 teachers and 360 students. Data collection was conducted through a validated survey questionnaire, with statistical analysis performed to determine relationships and significant differences.

Results: Findings indicate that students are predominantly mid-teenagers with balanced gender representation and varying levels of technological proficiency, while teachers are mostly young, female, and highly educated. AI integration in EIM teaching was assessed as moderately integrated across technological infrastructure, pedagogical practices, and training and support. Student engagement was found to be significantly high in cognitive, affective, and behavioral aspects. Notable differences in AI integration levels were observed based on students' age and technology proficiency. A strong positive correlation was identified between AI integration and student engagement, while a moderate positive correlation was noted with teacher engagement.

Conclusion: Based on the findings, the AI-Enhanced Learning Initiative (AELI) was proposed to optimize engagement and learning outcomes through structured training programs, AI-integrated curriculum development, and strengthened institutional support. Key recommendations include targeted AI training, enhanced technological infrastructure, continuous professional development for teachers, and further research on AI-driven instructional strategies to maximize student engagement.

Keywords: *Artificial Intelligence, Student Engagement, Electrical Installation and Maintenance.*

INTRODUCTION

The integration of artificial intelligence (AI) in education is reshaping teaching and learning methodologies across the globe. This transformative shift is not merely a technological advancement but a strategic response to the increasing demand for digital competency in the 21st century. Countries worldwide are leveraging AI to enhance student engagement, personalize learning experiences, and improve educational accessibility. However, while developed nations have made significant progress in AI-driven education, the adoption and integration of AI in the Philippine educational system present both challenges and opportunities that must be critically examined.

In the Philippines, education plays a crucial role in national development, yet the sector faces persistent challenges, including inadequate technological infrastructure, limited teacher training in emerging technologies, and disparities in access to digital tools. The implementation of AI in education, particularly in vocational and technical subjects such as Electrical Installation and Maintenance (EIM), offers a promising avenue for addressing these gaps. AI-enhanced learning can provide students with interactive simulations, real-time feedback, and personalized instruction, fostering deeper engagement and improved learning outcomes.



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Despite the national government's efforts to advance STEM education and integrate technology into the curriculum, the practical application of AI in technical-vocational education remains underexplored. This study, therefore, seeks to bridge this gap by examining how AI integration influences student engagement and learning outcomes in the teaching of EIM among Grade 10 students. Given that EIM is a critical skill area for the country's infrastructure and technological workforce, understanding the impact of AI in this field is essential for shaping future educational policies and practices.

Drawing upon empirical data and theoretical frameworks, this research explored the extent to which AI can enhance the teaching-learning process in the Philippine context. Studies such as those by Tedre et al. (2021) emphasize the need for innovative AI-driven pedagogies, emphasizing the need for innovative teaching approaches that can adapt to the complexities of machine learning and AI in the classroom. These findings underscore the importance of equipping educators with AI competencies and ensuring the necessary infrastructure is in place to support effective implementation.

This study contributes to both academic discourse and policy development by identifying best practices for AI integration in vocational education. The insights gained from this research will inform curriculum enhancements, teacher training programs, and institutional policies aimed at maximizing AI's potential in Philippine classrooms. Furthermore, the study aligns with the broader goal of preparing Filipino students for a technologically driven workforce, ultimately enhancing the nation's global competitiveness.

As the world moves toward an AI-powered future, it is imperative to examine how these advancements can be effectively harnessed in the Philippine educational system. By focusing on the integration of AI in EIM instruction, this research aims to provide concrete recommendations for optimizing AI use in education, ensuring that Filipino learners are equipped with the skills and competencies necessary for success in an increasingly digital world.

Objectives

The study investigated the integration of AI in teaching and students' engagement in EIM among Grade 10 students and teachers of Las Piñas National High School – Almanza in the Schools Division Office of Las Piñas City (SDO-LP) for the School Year 2023-2024.

Specifically, it sought to answer the following research questions:

1. What is the demographic profile of the two group of respondents in terms of:
 - 1.1 Students
 - 1.1.1 age;
 - 1.1.2 sex;
 - 1.1.3 socioeconomic status; and
 - 1.1.4 technology proficiency?
 - 1.2 Teachers
 - 1.2.1 age;
 - 1.2.2 sex;
 - 1.2.3 educational attainment;
 - 1.2.4 length of service; and
 - 1.2.5 technology proficiency?
2. What is the level of integration of Artificial Intelligence in teaching Electrical Installation and Maintenance (EIM) as assessed by the two-group of respondents in terms of:
 - 2.1 technological infrastructure;
 - 2.2. pedagogical integration; and
 - 2.3 training and support?
3. What is the level of engagement of the EIM learners as assessed by the two-group of respondents in terms of:
 - 3.1 cognitive;
 - 3.2 affective; and
 - 3.3 behavioral?
4. Is there a significant difference on the level of integration of AI in teaching EIM when grouped according to profile?



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5. Is there a significant relationship between the level of integration of AI in teaching EIM and the learners' level of engagement?
6. Based on the findings of the study, what output may be proposed?

Hypothesis

1. There is no significant difference on the level of integration of AI in teaching EIM when grouped according to profile.
2. There is no significant relationship between the level of integration of AI in teaching EIM and the learners' level of engagement.

METHODS

Research Design

This study employed a **quantitative research design**, specifically the **descriptive-correlational method**, as it is well-suited for systematically investigating and quantifying the relationship between the integration of AI in teaching and its impact on students' engagement within the **Electrical Installation and Maintenance (EIM) curriculum**. This design allows for the identification of patterns, trends, and associations between variables without manipulating them, ensuring an objective analysis of the data.

Population and Sampling

The study focused on teachers and Grade 10 students enrolled in the EIM program at Las Piñas National High School – Almanza, under the Schools Division Office of Las Piñas City (SDO-LP) for the School Year 2023-2024. The total population of the study consisted of 21 EIM teachers and 360 Grade 10 students, utilizing total enumeration sampling, ensuring all eligible participants were included for a comprehensive analysis of AI's impact on teaching and student engagement in vocational education.

Instrument

A researcher-made survey questionnaire was used as the primary data collection tool. The instrument was developed based on existing literature and frameworks related to AI integration in education and student engagement. To ensure its validity and reliability, the questionnaire underwent expert validation by three specialists in the field of educational technology and curriculum development. Their feedback led to revisions to enhance clarity, relevance, and alignment with the study's objectives.

To further establish the reliability of the instrument, a pilot testing was conducted with 30 students and 5 teachers who were not part of the actual study population. The Cronbach's Alpha coefficient was computed to determine the internal consistency of the questionnaire, with a score of 0.85, indicating a high level of reliability.

Data Collection

The data collection process followed a systematic approach to ensure accuracy, reliability, and ethical considerations. The steps included:

1. Questionnaire Development and Validation - The survey instrument was refined based on expert feedback.
2. Pilot Testing - A small group of respondents tested the questionnaire for reliability analysis.
3. Approval from the Schools Division Office (SDO-LP) - Official authorization was sought before conducting the research.
4. Distribution of Informed Consent Forms - Participants were provided with consent forms explaining the purpose and confidentiality of the study.
5. Dissemination of Questionnaires - Surveys were administered via Google Forms to ensure accessibility and efficiency.
6. Data Retrieval and Statistical Analysis - The responses were collected and analyzed using appropriate statistical treatments.



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Treatment of Data

The gathered data underwent statistical analysis to address the specific research questions with precision and rigor. The following statistical tools were employed:

- Descriptive Statistics (Mean, Standard Deviation) to determine the level of AI integration and student engagement.
- Pearson Correlation Coefficient to assess the relationship between AI integration and student engagement.
- Independent Samples t-test and ANOVA to identify significant differences in AI integration based on the demographic profile of respondents.

Ethical Considerations

The study adhered to high ethical standards to ensure the integrity of the research and the protection of participants' rights. The ethical principles observed included:

- Informed Consent - Participants voluntarily agreed to participate after being fully informed of the study's purpose and procedures.
- Confidentiality and Anonymity - Data was kept confidential, and no personally identifiable information was disclosed.
- Minimization of Potential Harm - The study posed no risk to participants, and they were free to withdraw at any time.
- Data Security - All collected data was securely stored and accessible only to the researchers.
- Transparency and Right to Withdraw - Participants had the right to ask questions and withdraw from the study at any point without consequences.

RESULTS and DISCUSSION

The highest number of respondents for students (68.6%) are aged 16-17, indicating that AI integration in EIM is primarily engaging mid-teenage students while for teachers are young to middle-aged, with 61.54% between 26-35 years old, suggesting a relatively early career stage.

As to the socioeconomic status most students come from low-income but not poor families (35.8%) and poor families (28.5%), indicating a predominance of lower socioeconomic backgrounds and Students' technology proficiency is evenly distributed between intermediate (26.3%) and expert (26.3%) levels, with a significant number also at the beginner level (24.5%).

As to educational attainment and length of service most teachers hold either a Bachelor's Degree (38.5%) or have completed Masteral Units (46.1%), indicating high academic qualifications and have relatively short teaching tenures, with 46.1% having five years or less of experience.

As to technology proficiency students are evenly distributed between intermediate (26.3%) and expert (26.3%) levels, with a significant number also at the beginner level (24.5%) while all teachers possess at least intermediate technological skills, with 46.1% at the intermediate level, 30.8% advanced, and 23.1% expert.

The majority of the respondents perceived the level of AI integration in terms of technological infrastructure as moderately integrated, with composite means reflecting adequate but improvable access to AI tools and resources. The integration of AI into pedagogical practices was also rated as moderately integrated by both groups, highlighting effective use in lesson planning and real-time feedback but indicating a need for more interactive learning environments. students generally rated training and support for AI integration as moderately integrated, and teachers perceived it as somewhat to moderately integrated, pointing to a disparity in perceptions and a need for more comprehensive training and robust support systems.

The respondents perceive high cognitive engagement among EIM learners with AI integration, particularly in applying theoretical knowledge to practical tasks and enhancing understanding and critical thinking. The integration of AI in EIM teaching has significantly enhanced students' affective engagement, marked by increased interest, motivation, emotional connection, satisfaction, and positive attitudes toward future learning. Both students and



teachers perceive high behavioral engagement among EIM learners with AI integration, particularly in proactive behaviors, active participation, timely completion of assignments, and adherence to classroom norms.

Level of Integration of Artificial Intelligence in Teaching Electrical Installation and Maintenance (EIM) in terms of Technological Infrastructure

The level of integration of Artificial Intelligence (AI) in teaching Electrical Installation and Maintenance (EIM) as assessed by students and teachers shows a varied yet generally moderate level of integration with over-all weighted mean of 2.695. This suggests that while AI tools and resources are present and somewhat accessible, and integration into the curriculum is happening, there is room for improvement, especially in institutional support and infrastructure maintenance. Both students and teachers perceive moderate integration, but the lower ratings from teachers suggest they may experience more challenges or perceive fewer benefits compared to students.

Table 1
Level of Integration of Artificial Intelligence in Teaching Electrical Installation and Maintenance (EIM) as Assessed by the Two-Group of Respondents in terms of Technological Infrastructure

Indicators	Students		Teachers		Composite Mean	Verbal Description
	Weighted Mean*	Verbal Description*	Weighted Mean*	Verbal Description*		
1.Our school has a wide range of AI-enabled tools and platforms readily available for teaching and learning Electrical Installation and Maintenance.	2.78	Moderately Integrated	2.46	Somewhat Integrated	2.62	Moderately Integrated
2.Students and teachers in our EIM program have easy access to AI resources and technologies for educational purposes.	2.88	Moderately Integrated	2.77	Moderately Integrated	2.825	Moderately Integrated
3.Artificial Intelligence is seamlessly integrated into the EIM curriculum.	2.78	Moderately Integrated	2.77	Moderately Integrated	2.775	Moderately Integrated
4.There is substantial support and training available for both students and teachers to effectively use AI technologies in the EIM course.	2.76	Moderately Integrated	2.62	Moderately Integrated	2.69	Moderately Integrated
5.Our institution regularly upgrades and maintains AI technological infrastructure to support its integration in teaching Electrical Installation and Maintenance.	2.77	Moderately Integrated	2.38	Somewhat Integrated	2.575	Moderately Integrated
Over-all Weighted Mean	2.79	Moderately Integrated	2.60	Moderately Integrated	2.695	Moderately Integrated

* Legend: Rating Scale Range Verbal Description
 4 3.26 – 4.00 Highly Integrated
 3 2.51 – 3.25 Moderately Integrated
 2 1.76 – 2.50 Somewhat Integrated



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1 1.00 – 1.75 Not at all integrated

Table 1 shows a composite means across all indicators reflect a generally moderate integration of AI in teaching EIM. The overall composite mean is 2.70, with students rating the overall integration at 2.79 and teachers at 2.60. This suggests that while AI tools and resources are present and somewhat accessible, and integration into the curriculum is happening, there is room for improvement, especially in institutional support and infrastructure maintenance. Both students and teachers perceive moderate integration, but the lower ratings from teachers suggest they may experience more challenges or perceive fewer benefits compared to students.

The review highlights that while AI has significant potential to enhance teaching and learning, its implementation often faces challenges such as insufficient infrastructure, lack of training, and inconsistent support, which align with the findings of this study. The moderately integrated rating reflects these challenges, indicating that while the potential of AI in education is recognized, practical barriers still need to be addressed to achieve higher levels of integration and effectiveness. This corroborates the empirical data, emphasizing the need for continuous improvement in AI infrastructure, support, and training to fully realize the benefits of AI in educational settings. (Zafari et al. 2022)

Level of Integration of Artificial Intelligence in Teaching Electrical Installation and Maintenance (EIM) in terms of Pedagogical Integration.

The level of integration of Artificial Intelligence (AI) in teaching Electrical Installation and Maintenance (EIM) as assessed by students and teachers reveals a generally moderate level of pedagogical integration across various indicators as shown in table 2.

Table 2
sas Assessed by the Two-Group of Respondents in terms of Pedagogical Integration.

Indicators	Students		Teachers		Composite Mean	Verbal Description
	Weighted Mean*	Verbal Description*	Weighted Mean*	Verbal Description*		
1.In our EIM program, artificial intelligence is utilized to create personalized learning experiences for students.	2.83	Moderately Integrated	2.85	Moderately Integrated	2.84	Moderately Integrated
2.Artificial intelligence systems are implemented to provide real-time feedback and assessments of students' work in the EIM course.	2.84	Moderately Integrated	2.92	Moderately Integrated	2.88	Moderately Integrated
3.Teachers leverage AI tools for developing lesson plans, ensuring that instructional content is aligned with students' learning needs and curriculum standards in EIM.	2.81	Moderately Integrated	2.85	Moderately Integrated	2.83	Moderately Integrated
4.AI technologies are integrated to foster interactive and engaging learning environments in EIM, such as through simulations or virtual labs.	2.72	Moderately Integrated	2.85	Moderately Integrated	2.785	Moderately Integrated



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5. There is a strong emphasis on professional development for teachers in the use of AI pedagogical strategies.	2.82	Moderately Integrated	3.08	Moderately Integrated	2.95	Moderately Integrated
Over-all Weighted Mean	2.81	Moderately Integrated	2.91	Moderately Integrated	2.86	Moderately Integrated

* Legend: Rating Scale Range Verbal Description

4	3.26 – 4.00	Highly Integrated
3	2.51 – 3.25	Moderately Integrated
2	1.76 – 2.50	Somewhat Integrated
1	1.00 – 1.75	Not at all integrated

Table 2 shows an overall composite mean across all indicators is 2.86, with students rating the overall integration at 2.81 and teachers at 2.91. This suggests that both students and teachers perceive the integration of AI into the pedagogical practices of EIM to be moderately integrated. The highest composite mean (2.95) indicates that there is significant emphasis on professional development for teachers, which is crucial for effective AI integration in teaching. However, the relatively lower ratings for creating interactive and engaging learning environments suggest that there may be room for improvement in using AI to enhance student engagement through interactive methods.

The study by Wang (2022) also emphasizes the importance of professional development for teachers, corroborating the higher ratings for this indicator in the current study. These findings suggest that while AI integration in EIM is progressing, continued focus on teacher training and developing engaging AI-driven learning activities is essential to fully realize the benefits of AI in education.

Level of Integration of Artificial Intelligence in Teaching Electrical Installation and Maintenance (EIM) in terms of Training and Support

The level of integration of Artificial Intelligence (AI) in teaching Electrical Installation and Maintenance (EIM) as assessed by students and teachers in terms of training and support shows varying degrees of integration as shown in Table 3.

Table 3
Level of Integration of Artificial Intelligence in Teaching Electrical Installation and Maintenance (EIM) as Assessed by the Two-Group of Respondents in terms of Training and Support

Indicators	Students		Teachers		Composite Mean	Verbal Description
	Weighted Mean*	Verbal Description*	Weighted Mean*	Verbal Description*		
1. Our institution offers comprehensive training programs for educators that cover the use of AI in teaching EIM.	2.68	Moderately Integrated	2.31	Somewhat Integrated	2.50	Somewhat Integrated
2. Continuous professional development opportunities related to AI in education are readily accessible to our teachers.	2.81	Moderately Integrated	2.54	Moderately Integrated	2.68	Moderately Integrated
3. There is a robust support system in place that educators can rely on when integrating AI into their	2.74	Moderately Integrated	2.77	Moderately Integrated	2.76	Moderately Integrated



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teaching of EIM, including technical support and pedagogical guidance.						
4.Our educational institution provides ample resources, including software, hardware, and learning materials, to support the integration of AI in the EIM curriculum.	2.90	Moderately Integrated	2.46	Somewhat Integrated	2.68	Moderately Integrated
5.There is an effective feedback mechanism that allows educators to share experiences and insights about using AI in teaching EIM.	2.88	Moderately Integrated	2.62	Moderately Integrated	2.75	Moderately Integrated
Over-all Weighted Mean	2.80	Moderately Integrated	2.54	Moderately Integrated	2.67	Moderately Integrated

* Legend: Rating Scale Range Verbal Description

4	3.26 – 4.00	Highly Integrated
3	2.51 – 3.25	Moderately Integrated
2	1.76 – 2.50	Somewhat Integrated
1	1.00 – 1.75	Not at all integrated

The overall composite mean across all indicators is 2.67, with students rating the overall integration at 2.80 and teachers at 2.54. This suggests that students generally perceive the level of training and support for AI integration in EIM as moderately integrated, while teachers view it as somewhat to moderately integrated. The disparity between student and teacher perceptions, particularly in the areas of training programs and resource availability, highlights potential gaps in support that may need to be addressed to enhance the effective integration of AI in teaching practices.

The use of AI to analyze class participation demonstrates the effectiveness of AI in evaluating student engagement. The study highlights the importance of adequate training and support for educators to effectively utilize AI tools. The findings emphasize that while there are efforts to provide training and resources, more targeted professional development and support mechanisms are necessary to bridge the gap between current practices and the optimal integration of AI in teaching EIM. This aligns with the empirical data, suggesting a need for continuous improvement in training and support to enhance the overall integration of AI in educational settings. (Liu, 2020)

Level of Engagement of the EIM Learners in terms of Cognitive

The following data describes the level of engagement of Electrical Installation and Maintenance (EIM) learners in terms of cognitive engagement, as assessed by students and teachers, shows high engagement across all indicators.



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Table 4
Level of Engagement of the EIM Learners as Assessed by the Two-Group of Respondents in terms of Cognitive

Indicators	Students		Teachers		Composite Mean	Verbal Description
	Weighted Mean*	Verbal Description*	Weighted Mean*	Verbal Description*		
1. With the integration of AI in EIM teaching, students demonstrate ability to understand complex concepts and solve problems more effectively.	2.83	High Engagement	3.00	High Engagement	2.92	High Engagement
2. Students are engaged in applying theoretical knowledge to practical tasks in EIM.	2.93	High Engagement	3.08	High Engagement	3.01	High Engagement
3. There is engagement among students in critical thinking and analysis of EIM topics.	2.93	High Engagement	3.00	High Engagement	2.97	High Engagement
4. Students exhibit engagement in actively participating in AI-integrated learning activities.	2.84	High Engagement	3.00	High Engagement	2.92	High Engagement
5. Students show engagement in reflective and self-regulated learning practices within the AI-enhanced EIM curriculum.	2.87	High Engagement	3.00	High Engagement	2.94	High Engagement
Over-all Weighted Mean	2.88	High Engagement	3.02	High Engagement	2.95	High Engagement

* Legend: Rating Scale Range Verbal Description
 4 3.26 – 4.00 Very High Engagement
 3 2.51 – 3.25 High Engagement
 2 1.76 – 2.50 Moderate Engagement
 1 1.00 – 1.75 Low Engagement

Table 4 shows the overall composite mean across all indicators is 2.95, with students rating the overall cognitive engagement at 2.88 and teachers at 3.02. This suggests that both students and teachers perceive a high level of cognitive engagement among EIM learners with the integration of AI. The highest composite mean (3.01) for applying theoretical knowledge to practical tasks indicates that AI integration is particularly effective in enhancing the practical application of knowledge. The consistent high engagement ratings across all indicators highlight the positive impact of AI on various aspects of cognitive engagement in the EIM curriculum.



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Liang (2022) explores the use of AI in constructing a human-machine collaborative teaching model to enhance Small Private Online Course (SPOC)-based teaching. The study found that AI improves interaction, resource optimization, and student learning outcomes, which align with the high engagement levels observed in the current study. The findings suggest that AI can significantly enhance cognitive engagement by making learning more interactive, practical, and reflective. This corroborates the empirical data, indicating that the integration of AI in EIM teaching fosters a deeper understanding of complex concepts, practical application of knowledge, and critical thinking, ultimately leading to higher student engagement and improved learning outcomes.

Level of Engagement of the EIM Learners in terms of Affective

The following data illustrates the level of engagement of Electrical Installation and Maintenance (EIM) learners in terms of affective engagement, as assessed by students and teachers, indicates high engagement across all indicators

Table 5
Level of Engagement of the EIM Learners as Assessed by the Two-Group of Respondents in terms of Affective

Indicators	Students		Teachers		Composite Mean	Verbal Description
	Weighted Mean*	Verbal Description*	Weighted Mean*	Verbal Description*		
1. Students exhibit interest in Electrical Installation and Maintenance subjects since the integration of artificial intelligence into the curriculum.	2.73	High Engagement	3.00	High Engagement	2.87	High Engagement
2. There is motivation among students to participate in AI-enhanced EIM classes.	2.84	High Engagement	3.15	High Engagement	2.99	High Engagement
3. Students display emotional connection to the learning material in EIM.	2.80	High Engagement	3.00	High Engagement	2.90	High Engagement
4. Students report sense of satisfaction in their learning achievements within the AI-integrated EIM curriculum.	2.75	High Engagement	2.92	High Engagement	2.84	High Engagement
5. There is engagement in terms of students' attitudes towards future learning in EIM.	2.98	High Engagement	3.00	High Engagement	2.99	High Engagement
Over-all Weighted Mean	2.82	High Engagement	3.02	High Engagement	2.92	High Engagement



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* Legend: Rating	Scale Range	Verbal Description
4	3.26 – 4.00	Very High Engagement
3	2.51 – 3.25	High Engagement
2	1.76 – 2.50	Moderate Engagement
1	1.00 – 1.75	Low Engagement

Table 5 shows an overall composite mean across all indicators is 2.92, with students rating the overall affective engagement at 2.82 and teachers at 3.02. This suggests that both students and teachers perceive a high level of affective engagement among EIM learners with the integration of AI. The highest composite mean (2.99) for motivation to participate in AI-enhanced EIM classes and students' attitudes towards future learning indicates that AI integration has positively impacted students' enthusiasm and outlook towards their studies. The consistent high engagement ratings across all indicators highlight the positive influence of AI on various aspects of affective engagement in the EIM curriculum.

Supporting these findings, González-Calatayud et al. (2021) conducted a systematic review on AI applications in student assessment, highlighting the role of AI in formative evaluation and automated grading. Their findings suggest that AI can enhance student engagement by providing timely and personalized feedback, which aligns with the high engagement levels observed in the current study. The integration of AI in EIM teaching not only fosters interest and motivation but also helps in building a strong emotional connection to the learning material and satisfaction with learning achievements. These findings underscore the potential of AI to significantly enhance affective engagement, corroborating the empirical data that show high levels of student interest, motivation, and positive attitudes towards learning in an AI-enhanced educational environment.

Level of Engagement of the EIM Learners in terms of Behavioral

The following data describes the level of engagement of Electrical Installation and Maintenance (EIM) learners in terms of behavioral engagement, as assessed by students and teachers, indicates high engagement across all indicators.

Table 6
Level of Engagement of the EIM Learners as Assessed by the Two-Group of Respondents in terms of Behavioral

Indicators	Students		Teachers		Composite Mean	Verbal Description
	Weighted Mean*	Verbal Description*	Weighted Mean*	Verbal Description*		
1. Students consistently complete their assignments on time and with diligence in the AI-enhanced EIM curriculum.	2.76	High Engagement	2.92	High Engagement	2.84	High Engagement
2. There is engagement among students, as evidenced by their active participation in class discussions and collaborative projects in AI-integrated EIM classes.	2.77	High Engagement	3.08	High Engagement	2.93	High Engagement
3. Students exhibit engagement through their regular attendance in AI-enhanced EIM classes, although there are	2.80	High Engagement	3.00	High Engagement	2.90	High Engagement



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occasional absences.						
4. Students show engagement in taking initiative beyond the required tasks in the AI-integrated EIM curriculum.	2.79	High Engagement	3.15	High Engagement	2.97	High Engagement
5. There is engagement among students in terms of adhering to classroom norms and rules during AI-integrated EIM lessons.	2.84	High Engagement	3.00	High Engagement	2.92	High Engagement
Over-all Weighted Mean	2.79	High Engagement	3.03	High Engagement	2.91	High Engagement

* Legend: Rating	Scale Range	Verbal Description
4	3.26 – 4.00	Very High Engagement
3	2.51 – 3.25	High Engagement
2	1.76 – 2.50	Moderate Engagement
1	1.00 – 1.75	Low Engagement

Table 6 shows an overall composite mean across all indicators is 2.91, with students rating the overall behavioral engagement at 2.79 and teachers at 3.03. This suggests that both students and teachers perceive a high level of behavioral engagement among EIM learners with the integration of AI. The highest composite mean (2.97) for students taking initiative beyond required tasks indicates that AI integration has positively impacted students' proactive behaviors in their studies. The consistent high engagement ratings across all indicators highlight the positive influence of AI on various aspects of behavioral engagement in the EIM curriculum.

Supporting these findings, Shen (2023) designed a teaching supervision platform using AI and network communication technology to monitor classroom behaviors and enhance student learning and teacher feedback accuracy. The study highlights the importance of AI in promoting active participation and adherence to classroom norms, which aligns with the high engagement levels observed in the current study. The integration of AI in EIM teaching not only fosters timely completion of assignments and regular attendance but also encourages students to take initiative and actively participate in class activities. These findings underscore the potential of AI to significantly enhance behavioral engagement, corroborating the empirical data that show high levels of student diligence, participation, and adherence to classroom norms in an AI-enhanced educational environment.

Conclusion

The study highlights the significant impact of artificial intelligence (AI) integration in teaching Electrical Installation and Maintenance (EIM) among Grade 10 students. Findings indicate that AI positively influences student engagement, particularly in cognitive, affective, and behavioral aspects, while also moderately enhancing teacher engagement. Despite the moderate integration of AI across technological infrastructure, pedagogical practices, and training, the results underscore its potential in improving educational outcomes. Additionally, demographic factors such as age and technology proficiency influence the effectiveness of AI integration, whereas gender and socioeconomic status do not exhibit significant differences. The study supports the implementation of structured AI programs, such as the AI-Enhanced Learning Initiative (AELI), to provide comprehensive training, curriculum development, and ongoing support systems. Overall, the research underscores the necessity of AI in modernizing vocational education, ensuring that students acquire the necessary competencies to thrive in a technology-driven workforce.

Recommendation

Based on the findings, several recommendations are proposed to enhance AI integration in EIM education. First, AI training programs should be tailored to accommodate varying levels of technological proficiency among



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students and the unique needs of young, highly educated teachers. Second, institutions should prioritize the enhancement of technological infrastructure and pedagogical approaches to facilitate AI adoption effectively. Third, continuous professional development initiatives should be implemented to empower educators in leveraging AI tools to boost student engagement further. Additionally, AI integration strategies must be designed with consideration for students' age and technology proficiency, ensuring accessibility and effectiveness. Expanding AI-supported teaching methodologies can further strengthen engagement levels while providing teachers with additional resources to enhance instructional delivery. Finally, further research should explore the most effective AI tools for improving various aspects of student engagement, ensuring that future implementations are data-driven and impactful.

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