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Students' perception of the impact of AI integration on learning: Effectiveness and challenges

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A R T I C L E I N F O

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A B S T R A C T

Artificial Intelligence (AI) has become an increasingly influential technology in education, offering new opportunities to enhance learning effectiveness, academic performance, and student engagement. This study examined the effectiveness of AI integration in learning in terms of classroom engagement, academic performance, and learning habits, as well as its outcomes and associated challenges among Grade 11 students at Data Center College of the Philippines. A mixed-method research design was employed, combining quantitative survey data from 137 students and qualitative responses from 20 selected participants. The quantitative data were analyzed using mean and descriptive interpretation, while qualitative data were analyzed using thematic analysis. The findings revealed that students generally perceived AI as effective in supporting their learning, with an overall mean of 3.00, interpreted as Agree. AI-enhanced classroom engagement by improving motivation, confidence, and participation. It also supported academic performance by improving students' efficiency in retrieving information, completing assignments, and managing academic tasks. In terms of learning habits, AI improved productivity, time management, and access to academic resources. However, the study also identified challenges such as over-reliance on AI, reduced critical thinking, academic integrity concerns, data privacy risks, and internet accessibility limitations. The study concludes that AI serves as a valuable instructional support tool that enhances engagement, academic productivity, and learning efficiency. However, its effectiveness depends on responsible use, proper instructional guidance, and institutional support. Teachers and educational institutions play an essential role in ensuring ethical and balanced integration of AI to promote independent thinking and meaningful learning. The findings provide important insights for educators, school administrators, and policymakers to develop strategies and policies that ensure the effective and responsible use of AI in education.

Introduction

Artificial intelligence is rapidly transforming education by changing how students access information, engage in learning, and accomplish academic tasks. These intelligent technologies enhance learning efficiency, improve academic performance, and support diverse learning needs by providing instant feedback, personalized learning support, and accessible academic resources. Because of these capabilities, artificial intelligence has become an important educational tool that influences students'

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learning experiences, engagement, and overall academic success. Understanding its effectiveness is essential to ensure that its integration contributes positively to students' learning and development.

Globally, artificial intelligence has been widely integrated into educational systems to enhance instructional delivery and learning effectiveness. Educational institutions use intelligent technologies such as adaptive learning platforms, tutoring systems, and generative AI applications to support learners' academic needs. Holmes, Bialik, and Fadel (2019) emphasized that artificial intelligence improves accessibility, instructional efficiency, and personalized learning experiences, while Zawacki-Richter et al. (2019) highlighted its role in improving learning outcomes through adaptive feedback and individualized instruction. However, concerns remain regarding over-reliance, ethical issues, and its potential impact on students' critical thinking and independent learning skills (Kasneci et al., 2023; Selwyn, 2019).

Although international studies demonstrate the potential of AI to enhance engagement and academic achievement (Chen et al., 2020; Roll & Wylie, 2016), significant gaps remain. Most empirical investigations focus on tertiary education and developed countries (Zawacki-Richter et al., 2019). There is limited localized research on the use of AI in Senior High School contexts in developing nations such as the Philippines. Furthermore, prior studies often analyze academic performance or technology acceptance in isolation, with fewer examining classroom engagement, academic achievement, and self-observation of learning habits simultaneously within a mixed-methods framework. Considering the Philippines' performance in PISA 2018 (OECD, 2019), there is a compelling need for context-specific empirical research to determine whether AI integration can serve as an instructional strategy to improve engagement and academic outcomes among Grade 11 students. This study addresses these contextual and methodological gaps by providing localized evidence on the use of AI in Philippine Senior High School education. In the Philippines, the use of digital technologies in education has increased significantly, particularly following the shift toward technology-supported learning. The Department of Education (DepEd, 2020) emphasized the integration of technology to support learning continuity and improve educational outcomes. Despite these efforts, challenges such as limited technological resources, internet connectivity issues, and varying levels of digital literacy continue to affect effective implementation (UNESCO, 2021). While artificial intelligence offers potential benefits, its impact on students' academic engagement, performance, and learning habits in the Philippine context requires further investigation. At the local level, students increasingly use artificial intelligence tools to support academic tasks, improve comprehension, and enhance study efficiency. These technologies provide convenient access to learning resources and academic support. However, students also face challenges such as overdependence, concerns about academic integrity, and accessibility limitations. Artificial intelligence provides personalized instructional support and improves learning efficiency (Chen, Chen, & Lin, 2020; Roll & Wylie, 2016), but excessive reliance may negatively affect independent thinking and genuine learning engagement (Selwyn, 2019; Kasneci et al., 2023).

Despite the growing use of artificial intelligence in education, limited research has examined its effectiveness based on students' actual experiences, particularly in the local context. Most studies focus on technological development rather than students' perception of its effectiveness in terms of classroom engagement, academic performance, and learning habits. This gap highlights the need to examine how

students perceive the integration of artificial intelligence and its influence on their learning experiences. Therefore, this study aims to examine students' perceptions of integrating artificial intelligence into learning, including its effectiveness, outcomes, and challenges. The findings will provide valuable insights for educators, school administrators, and policymakers in ensuring the responsible and effective integration of artificial intelligence in education.

Literature review

Global academic performance and educational challenges

One of the major challenges affecting global academic performance is inequality in access to quality education. Many educational systems, especially in developing countries, lack adequate infrastructure, instructional materials, and qualified teachers. These limitations hinder students' ability to develop essential literacy, numeracy, and scientific skills, resulting in disparities in academic achievement and reduced educational opportunities (World Bank, 2018; UNESCO, 2021). Differences in instructional quality also affect academic performance. Inadequate teacher preparation, limited professional development, and high teacher-to-student ratios reduce instructional effectiveness and contribute to learning gaps and lower academic achievement (OECD, 2019; Darling-Hammond et al., 2017).

Socioeconomic disparities further influence academic outcomes. Students from low-income backgrounds often have limited access to educational technologies, academic support, and conducive learning environments, which negatively affect engagement and performance (Reimers, 2020; OECD, 2018). The digital divide also limits learning opportunities, as unequal access to devices and internet connectivity prevents many students from benefiting from technology, leading to learning loss and reduced academic progress (UNESCO, 2021; World Bank, 2020).

Learning loss and weak foundational skills remain major concerns, as many students lack basic literacy and numeracy competencies necessary for academic success. Learning poverty continues to affect students' ability to understand advanced content and limits future opportunities (World Bank, 2019; UNICEF, 2022).

Student engagement and motivation are also essential for academic success. Low engagement reduces participation, comprehension, and achievement, especially in environments lacking interactive and meaningful learning experiences (Fredricks et al., 2019; Bond et al., 2020). Additionally, rapid technological advancement presents challenges such as limited infrastructure, insufficient training, and lack of readiness, which reduce the effectiveness of educational technologies (OECD, 2021; Holmes et al., 2019). These challenges highlight the need for innovative solutions to improve academic performance. Addressing inequality, improving instructional quality, expanding access to technology, and increasing student engagement are essential. These issues also emphasize the importance of exploring artificial intelligence as a tool to enhance learning effectiveness and academic performance.

Artificial Intelligence in Education

Artificial intelligence (AI) has become an influential technology in education, offering innovative solutions to improve learning effectiveness, instructional quality, and academic performance. AI refers to computer systems that simulate human intelligence, including learning, reasoning, and decision-making. In education, AI is used through intelligent tutoring systems, adaptive learning platforms, automated assessments, and generative AI tools. These technologies enhance teaching and learning by providing personalized instruction, improving efficiency, and supporting learners' academic needs. AI enables adaptive learning support that improves learning effectiveness and has the potential to enhance accessibility, efficiency, and instructional quality (Chen et al., 2020; Holmes et al., 2019). One of the main advantages of AI is its ability to provide personalized learning experiences. AI systems analyze learners' performance and progress to deliver customized instructional content suited to individual needs. This adaptive approach allows learners to progress at their own pace, improving comprehension and retention. AI-powered systems also provide individualized feedback and targeted support, which enhances learning outcomes and effectiveness (Zawacki-Richter et al., 2019; Roll & Wylie, 2016).

AI also improves instructional effectiveness by assisting educators in monitoring student progress and delivering quality instruction. Automated grading, assessment, and feedback allow teachers to focus more on instructional planning and student support. AI helps identify learning gaps and provides real-time feedback, enabling educators to improve instructional decisions and teaching efficiency (Luckin et al., 2016; Chen et al., 2020). In addition, AI enhances student engagement and motivation by providing interactive and adaptive learning environments. AI tools such as virtual tutors promote active participation and independent learning. These systems improve engagement, motivation, and academic performance by offering personalized and interactive learning experiences (Chassignol et al., 2018; Crompton & Burke, 2023). AI also promotes accessibility and equity by providing flexible learning opportunities. AI-powered platforms enable learners to access educational resources anytime, anywhere, reducing barriers related to location and resource availability. AI supports inclusive education by providing personalized learning and addressing diverse learner needs (UNESCO, 2021; Holmes et al., 2019). Despite its benefits, AI integration also presents challenges, including ethical concerns, data privacy issues, and over-reliance on technology. Excessive dependence on AI may reduce critical thinking and independent learning skills, while improper use may affect academic integrity and learning quality (Selwyn, 2019; Kasneci et al., 2023). These concerns highlight the importance of responsible and effective AI implementation to maximize its educational benefits while minimizing potential risks.

Classroom engagement

Classroom engagement is an important factor influencing academic performance and learning effectiveness. It refers to students' active participation, attention, and involvement in learning activities. Engaged learners demonstrate higher motivation, persistence, and effort, which leads to improved academic achievement. Classroom engagement encompasses behavioral, emotional, and cognitive components that support active participation, positive attitudes, and a deeper understanding of academic content (Fredricks et al., 2016). Engagement has a strong positive relationship with academic performance. Students who actively participate in learning activities show better comprehension, retention, and achievement. Engagement promotes focus, critical thinking, and effective learning

strategies, which improve academic outcomes (Lei et al., 2018; Bond et al., 2020). Student motivation also plays a key role in engagement. Motivated learners are more likely to participate actively and persist with learning tasks, thereby strengthening academic skills and improving performance (Hiver et al., 2021). Instructional strategies such as interactive teaching, collaboration, and technology-supported instruction also enhance engagement and create meaningful learning experiences (Darling-Hammond et al., 2017).

Technology, particularly artificial intelligence, further improves engagement by providing personalized learning, adaptive support, and real-time feedback. These features increase participation, motivation, and learning effectiveness (Bond et al., 2020; Crompton & Burke, 2023; Zawacki-Richter et al., 2019). However, maintaining engagement remains a challenge due to low motivation, ineffective teaching methods, and limited access to technology. Low engagement is associated with poor academic performance and reduced learning outcomes (Fredricks et al., 2019). Overall, classroom engagement plays a crucial role in improving academic performance. Promoting engagement through effective teaching strategies and AI-supported technologies can enhance learning outcomes and academic success.

Academic performance

Academic performance is a fundamental indicator of educational attainment and reflects the extent to which instructional objectives and learning goals are achieved. It is typically evaluated through various measures, including examinations, grades, standardized assessments, and overall scholastic progress. This construct reflects the acquisition of knowledge, the development of cognitive abilities, and the capacity to apply concepts in academic contexts. York, Gibson, and Rankin (2015) emphasized that scholastic achievement is closely linked to learning outcomes and is widely recognized as a key measure of instructional effectiveness and overall student success. Multiple factors contribute to academic success, including intellectual abilities, motivation, study strategies, and access to educational resources. Effective strategies such as active participation, self-regulation, and proper time management play essential roles in improving learning outcomes. Broadbent and Poon (2015) explained that individuals who use self-regulated approaches achieve more because they can effectively manage their study processes and maintain focus on academic responsibilities. These methods enhance comprehension and contribute to improved educational attainment. Motivation is another essential component influencing scholastic success. Individuals who demonstrate strong internal drive are more likely to exert effort, remain persistent, and actively participate in academic activities. Schunk and DiBenedetto (2020) noted that motivation increases the willingness to engage in learning tasks, thereby contributing to improved achievement. Those with higher levels of drive are better able to overcome academic challenges and maintain consistent progress toward educational goals. Active participation in instructional activities also plays a vital role in improving learning outcomes. Individuals who engage in discussions, collaborative tasks, and academic exercises demonstrate stronger comprehension and persistence. Lei, Cui, and Zhou (2018) found that participation significantly predicts educational achievement, as actively involved learners demonstrate higher levels of attention and understanding. Meaningful involvement strengthens knowledge acquisition and promotes better scholastic outcomes. The availability of digital learning tools and technological resources also contributes to improved educational attainment. Technology-supported environments provide access to instructional materials, interactive platforms, and academic assistance that enhance understanding. Bond et al. (2020) reported that digital learning tools

support achievement by improving engagement, increasing motivation, and expanding access to educational content. These resources enable learners to better understand complex information and complete tasks more efficiently.

Artificial intelligence, as an advanced instructional technology, offers additional support for improving learning outcomes. Intelligent systems provide personalized guidance, immediate feedback, and adaptive instructional assistance that address individual needs. Zawacki-Richter et al. (2019) highlighted that intelligent educational systems strengthen achievement by supporting individualized instruction and enhancing teaching effectiveness. Similarly, Chen, Chen, and Lin (2020) found that intelligent platforms improve educational outcomes by delivering customized learning experiences and targeted academic support. Despite these advancements, several barriers continue to affect educational success. Limited motivation, restricted access to learning resources, and ineffective teaching approaches can negatively influence achievement. Socioeconomic conditions and environmental factors also play significant roles in determining learning outcomes. The World Bank (2018) reported that individuals from disadvantaged backgrounds often experience lower educational attainment due to limited access to quality instruction and academic support. Addressing these barriers is essential to improving educational outcomes and promoting academic success. Overall, academic performance reflects the effectiveness of instructional methods, learning behaviors, and educational support systems. Factors such as motivation, engagement, effective learning strategies, and access to technological resources significantly influence educational outcomes. Strengthening instructional practices, expanding access to learning tools, and integrating advanced technologies such as artificial intelligence can enhance educational effectiveness and support improved academic success.

Self-observation on learning habits

Self-observation of learning habits refers to the process of monitoring and evaluating one's study behaviors, strategies, and progress to improve academic outcomes. This process helps learners identify their strengths and weaknesses and adjust their strategies to achieve academic goals. Self-monitoring plays an important role in self-regulated learning, as it enables learners to evaluate their progress and take responsibility for their learning (Zimmerman & Schunk, 2015). Reflective monitoring of study behaviors contributes to improved academic performance. Learners who regularly evaluate their study habits can identify ineffective strategies and adopt more effective approaches. Reflective regulation strengthens awareness of learning processes and improves the ability to manage academic tasks successfully (Panadero, 2017). Metacognitive awareness, which involves understanding and regulating one's thinking processes, also improves comprehension, retention, and overall academic achievement (Dunlosky & Metcalfe, 2016). Learners who actively regulate their learning demonstrate greater independence and improved academic performance (Broadbent & Poon, 2015). Technological advancements, including artificial intelligence, have enhanced learners' ability to monitor their progress. AI-supported platforms provide real-time feedback and personalized guidance, helping learners improve their learning strategies and academic performance (Roll & Wylie, 2016). Monitoring progress also strengthens motivation and persistence, as learners can see their improvement and remain committed to their academic goals (Schunk & DiBenedetto, 2020).

However, effective self-monitoring requires proper guidance and support. Structured feedback and supportive learning environments help learners develop strong self-regulation skills and improve academic outcomes (Panadero, 2017).

Overall, self-observation of learning habits plays a vital role in improving academic performance, strengthening self-regulation, and promoting independent learning. The use of AI and educational technologies further enhances learners' ability to monitor progress and improve learning effectiveness.

Study habits

Study habits are the consistent behaviors, routines, and strategies individuals use to acquire, understand, and retain academic information. These practices include time management, organization, concentration, note-taking, and effective learning techniques. Good routines enable learners to process information efficiently and achieve better educational outcomes. Credé and Kuncel (2017) explained that effective learning routines significantly predict educational achievement, as consistent and structured approaches improve comprehension, retention, and overall academic success. Effective time management is one of the most important components of productive academic routines. Learners who allocate sufficient time for reviewing materials, completing assignments, and preparing for assessments demonstrate stronger academic outcomes. Broadbent and Poon (2015) found that proper scheduling and self-regulation contribute to higher achievement by helping individuals maintain focus and complete academic responsibilities efficiently. Organized planning supports improved concentration and reduces academic stress. Consistent review of lessons also strengthens knowledge retention and understanding. Regular revision helps reinforce previously learned concepts and improves long-term memory. Dunlosky et al. (2016) emphasized that repeated practice and distributed learning improve retention and academic performance by strengthening cognitive processing. Learners who consistently review materials demonstrate improved comprehension and stronger academic results. Environmental factors also influence the effectiveness of learning routines. A quiet, organized, and distraction-free environment supports concentration and enhances productivity. According to Zimmerman and Schunk (2015), structured learning environments promote better focus, allowing individuals to engage more effectively in academic tasks. Minimizing distractions improves attention and contributes to better educational outcomes.

Artificial intelligence has further enhanced the development of productive academic routines by providing personalized guidance and feedback. Intelligent systems monitor progress, identify learning gaps, and recommend appropriate learning strategies. Chen, Chen, and Lin (2020) explained that intelligent educational technologies support effective learning behaviors by providing adaptive instruction and real-time feedback. These systems strengthen independent learning and contribute to improved academic outcomes. Digital platforms provide access to educational materials, organizational tools, and academic support that enhance productivity. Bond et al. (2020) reported that technology-supported environments improve learning behaviors by increasing engagement, providing access to resources, and supporting independent learning. These tools allow individuals to organize their academic responsibilities more effectively.

Despite their importance, developing effective routines can be challenging due to distractions, lack of motivation, and poor time management. Inconsistent practices and ineffective strategies may negatively affect academic success. Credé and Kuncel (2017) emphasized that poor academic routines are associated with lower educational achievement and reduced learning effectiveness. Strengthening effective learning behaviors is essential to improving educational outcomes. Overall, productive academic routines play a vital role in improving educational achievement, strengthening learning effectiveness, and supporting academic success. Effective planning, consistent review, proper organization, and access to supportive technologies contribute to improved educational outcomes. Strengthening these practices promotes independent learning and enhances overall academic performance.

Conceptual framework

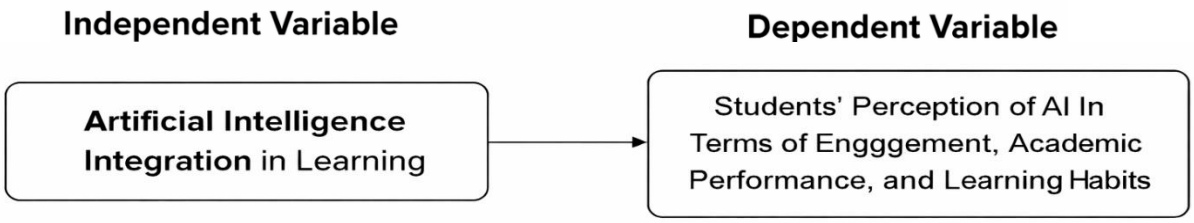

Figure 1. Research Paradigm

Statement of the problems

The primary purpose of this study was to examine the impact of Artificial Intelligence (AI) integration on student engagement, academic performance, and learning habits among Grade 11 students at Data Center College of Laoag, Senior High School.

Specifically, this study sought to answer the following questions:

1. How do students perceive the effectiveness of AI integration in terms of:
   1.1. Classroom Engagement;
   1.2. Academic Performance; and
   1.3. Self-observation on its impact on learning habits?

2. What are the outcomes of AI integration based on students' perception in terms of:
   2.1. Changes in study habits or learning approaches;
   2.2 Challenges and concerns experienced by the students?

Research methodology

This chapter presented the research design, the study locale, population, sampling, data presentation instrument, data-gathering procedure, research methodology, ethical considerations, and data presentation and analysis.

Research design

This study employs a mixed-method approach, combining both quantitative and qualitative data to provide a comprehensive analysis of the impact of artificial intelligence (AI) on students' educational experiences. The quantitative data were collected through a structured survey, while the qualitative data were gathered through open-ended questions. This approach allows for a more nuanced understanding of students' experiences and perspectives.

Locale of the study

The study was conducted at the Data Center College of the Philippines, encompassing various academic strands, including HUMSS, STEM, ABM, CGV, and HRS. The research took place in the second semester of the 2023-2024 academic year, providing a timely and relevant context for the study.

Population and sampling

The study population consisted of Grade 11 students enrolled at Data Center College of the Philippines – Senior High School during the second semester of Academic Year 2023–2024. The respondents were drawn from the following academic strands: HUMSS, STEM, ABM, CGV, HRS, and ICT. A total of 137 students participated in the study, composed of 40 males and 97 females.

A total enumeration sampling technique was employed for the quantitative phase of the research. All available and willing Grade 11 students during the data collection period were included in the survey to ensure broader representation across strands. For the qualitative component, purposive sampling was utilized. Twenty (20) students were intentionally selected to provide in-depth responses to open-ended questions, ensuring representation from various academic strands and both genders. This approach enabled the study to capture diverse perspectives while remaining relevant to the research objectives.

Data gathering instruments

Instruments used in this study included a quantitative survey questionnaire with a Likert scale, featuring categories ranging from "Disagree" to "Strongly Agree," structured around three main themes. Category A, "As to classroom engagement," comprised items probing students' levels of participation, collaboration, motivation, self-directed learning, attention, confidence, and attendance. Category B, "As to my academic performance," assessed the influence of AI on students' academic achievements, encompassing comprehension, assignment completion, quiz and exam scores, stress management, information retrieval efficiency, and reasoning skills. Category C, "As to self-observation on its impact on my learning habits," delved into students' personal reflections regarding AI's effects on their learning behaviors.

Additionally, an open-ended question was administered to 20 selected students, focusing on three distinct inquiries: Question 1 explored changes in study habits or learning approaches resulting from AI use, Question 2 addressed challenges or concerns regarding AI's impact on academic engagement, and Question 3 solicited recommendations for AI utilization in education. This comprehensive approach facilitated a nuanced understanding of students' perspectives on AI integration in educational settings by combining quantitative assessments with qualitative insights from open-ended responses.

The instrument used in securing the data was a questionnaire checklist. This was supported by an interview with the respondent.

Part I covered the respondents' personal profiles. Part II identified the effectiveness of using AI on student engagement and academic performance.

Category	Number of items	Category Description
As to my classroom engagement	7	This category examines how AI affects student participation, collaboration, motivation, self-directed learning, attention, confidence, and attendance.
As to my academic performance	7	This section evaluates the influence of AI on students' academic achievements.
As to self-observation on its impact on my learning habits	7	This category assesses students' personal observations of AI's impact on their learning habits.

For every item, the respondents were given five choices to select. Such choices are as follows:

Range	Scale	Descriptive Interpretation
4.51- 5.00	5	Very Strongly Agree
3.51 – 4.50	4	Very Agree
2.51 - 3.50	3	Agree
1.51 – 2.50	2	Slightly Agree
1.00 – 1.50	1	Disagree

Part III determines the impact of AI on students' learning habits and the changes encountered, and gathers recommendations through open-ended questions.

Ethical considerations

Ethical standards were strictly observed throughout the conduct of this study. Prior to data collection, formal permission was secured from the school administration of Data Center College of the Philippines – Senior High School. Participants were clearly informed about the research's purpose, the procedures involved, and their role in the study. Informed consent was obtained from all respondents, and they were assured that participation was entirely voluntary. Students were informed that they could withdraw from the study at any time without penalty or academic consequences.

Confidentiality and anonymity were carefully maintained to protect participants' identities. No names or personally identifiable information were included in the questionnaire or in the presentation of results. Responses were encoded using numerical identifiers to ensure privacy. All collected data were used solely for academic and research purposes and were stored securely to prevent unauthorized access.

The study avoided any form of deception, coercion, or manipulation. Participants were treated with respect and fairness throughout the process. Findings were reported honestly and objectively, ensuring accuracy and integrity in data presentation.

By adhering to these ethical principles, the research safeguarded the rights, dignity, and well-being of all participants.

Data presentation and analysis

Problem 1: How do the students perceive the effectiveness of AI in terms of classroom engagement?

Table 1 shows the effectiveness of artificial intelligence in terms of classroom engagement, with a composite mean of 3.02, interpreted as Agree, indicating that students generally perceive AI as supportive of their engagement in learning activities. The highest mean was obtained by the statement *"Using AI, I've become more responsible in my attendance rates"* (Mean = 3.20), followed by *"Using AI, I became more confident in speaking and sharing my opinion in front of my teacher and my classroom"* (Mean = 3.18), suggesting that AI contributes to improved responsibility and confidence in classroom participation. Additionally, the indicators related to motivation for active learning (Means = 3.16 and 3.15), attention and interest (Mean = 2.91), and collaboration (Mean = 2.94) were all interpreted as Agree, indicating that AI helps sustain students' interest and participation during lessons. The lowest mean was observed for "The use of AI contributes to my self-directed learning" (Mean = 2.66), which is still interpreted as Agree, suggesting that AI supports independent learning but may still require instructional guidance.

These results are supported by Zawacki-Richter et al. (2019), who explained that AI enhances engagement through personalized learning and feedback, and Crompton and Burke (2023), who noted that intelligent educational technologies improve participation and motivation by providing interactive learning environments. Similarly, Fredricks et al. (2016) emphasized that engagement improves when learners actively participate and develop confidence in learning activities, while Bond et al. (2020) highlighted that educational technologies strengthen engagement by providing accessible learning support and improving learner involvement.

Table 1. 1. ***Students' perception of the effectiveness of AI in terms of classroom engagement***

Item	Description	Very Strongly Agree (5)	Very Agree (4)	Agree (3)	Slightly Agree (2)	Disagree (1)	Mean	Descriptive Interpretation
1	Using AI, I am more motivated for active learning	28	28	37	26	18	**3.16**	**Agree**
2	Using AI, I am more engaged in collaboration and interaction in group activities	17	29	41	29	21	**2.94**	**Agree**
3	Using AI, I am more motivated for active learning	28	27	39	24	19	**3.15**	**Agree**

4	The use of AI contributes to my self-directed learning	12	24	38	32	31	**2.66**	**Agree**
5	The use of AI captures and maintains my attention and interest during the lesson	18	28	39	28	24	**2.91**	**Agree**
6	Using AI, I became more confident in speaking and sharing my opinion in front of my teacher and my classroom	40	22	24	25	26	**3.18**	**Agree**
7	Using AI, I've become more responsible in my attendance rates	38	21	31	24	23	**3.20**	**Agree**
Composite Mean:							**3.02**	**Agree**

Source of Data: *Data were obtained from the responses of 137 Grade 11 students from the HUMSS, STEM, ABM, CGV, HRS, and ICT strands at Data Center College of the Philippines, Inc.-Laoag City, based on questionnaires administered on March 22, 2024.*

Note:

4.51 - 5.00	Very Strongly Agree
3.51 - 4.50	Strongly Agree
2.51 - 3.50	Agree
1.51 – 2.50	Slightly Agree
1.00 – 1.50	Disagree

1.2. How do the students perceive the effectiveness of AI in terms of academic performance?

Table 4 presents students' perceptions of the effectiveness of artificial intelligence on academic performance, with a composite mean of 2.88 (interpreted as Agree), indicating that AI is generally perceived as supportive in improving their academic outcomes.

The highest mean was observed for "The use of AI impacted the efficiency of my information retrieval during the learning process" (Mean = 3.14), suggesting that AI helps students access and process academic information more efficiently, thereby supporting learning and task completion. This was followed by *"It helped me in the completion of my assignments and projects"* (Mean = 3.00) and *"The use of AI helped me overcome academic stress"* (Mean = 2.97), indicating that AI assists learners in managing academic tasks and reducing learning-related difficulties. Additionally, the indicators related to improved quiz and examination scores (Mean = 2.94), improved grades (Mean = 2.85), and better understanding of complex subjects (Mean = 2.63) were all interpreted as "Agree," indicating that AI contributes to improved comprehension and academic productivity. The lowest mean was observed in *"The use of AI helped me enhance my comprehension and reasoning skills"* (Mean = 2.61), although still interpreted as Agree, suggesting that AI supports academic learning but may still require teacher guidance to fully develop higher-order thinking skills.

These results are supported by Chen, Chen, and Lin (2020), who explained that AI improves academic performance by providing adaptive learning support and personalized instruction, and Zawacki-Richter et al. (2019), who emphasized that intelligent educational technologies enhance learning outcomes by improving access to information and individualized feedback. Similarly, Bond et al. (2020) reported that educational technologies improve academic performance by increasing learning efficiency and supporting academic tasks, while Schunk and DiBenedetto (2020) emphasized that technological support enhances students' motivation and academic achievement by helping them complete academic requirements more effectively.

Table1.2. ***Students' perception of the effectiveness of AI in terms of academic performance***

Item	Description	Very Strongly Agree (5)	Very Agree (4)	Agree (3)	Slightly Agree (2)	Disagree (1)	Mean	Descriptive Interpretation
1	Using AI, I have improved my understanding of complex subjects	35	21	28	23	30	**2.63**	**Agree**
2	It helped me in the completion of my assignments and projects	31	24	27	24	31	**3.00**	**Agree**
3	It helped me improve my scores in quizzes and examinations	31	21	26	27	32	**2.94**	**Agree**
4	The use of AI helped me overcome academic stress	23	29	34	23	28	**2.97**	**Agree**
5	The use of AI impacted the efficiency of my information retrieval during the learning process	36	21	27	32	21	**3.14**	**Agree**
6	The use of AI helped me enhance my comprehension and reasoning skills	19	22	28	29	32	**2.61**	**Agree**
7	The use of AI plays an important role in improving my grades	27	21	27	28	34	**2.85**	**Agree**
Composite Mean:							**2.88**	**Agree**

Source of Data: *Data were obtained from the responses of 137 Grade 11 students from HUMSS, STEM, ABM, CGV, HRS, and ICT strands of Data Center College of the Philippines, Inc.- Laoag City, based on questionnaires administered on March 22, 2024.*

1.3. How do the students perceive the effectiveness of AI in terms of learning habits?

Table 3 presents students' perceptions of the effectiveness of artificial intelligence regarding learning habits, with a composite mean of 3.00 (interpreted as Agree), indicating that AI significantly influences their study behaviors and learning routines.

The highest mean was observed for "It is so costly because I cannot use it without paying for internet" (Mean = 3.39), suggesting that while AI supports learning, access to internet connectivity remains a concern that affects consistent use. This was followed by *"I've become more engaged to it that whenever we are not using it, my interest in learning decreases"* (Mean = 3.20) and *"I have become more or over-reliant on AI that I could no longer think without its help"* (Mean = 3.10), indicating that AI increases engagement but may also lead to dependence. Additionally, the indicators related to distraction from other applications (Mean = 2.97), faster and easier academic tasks (Mean = 2.79), limitations in obtaining exact answers (Mean = 2.77), and reduced support for critical thinking (Mean = 2.76) were all interpreted as Agree, showing that AI affects both the efficiency and challenges associated with learning habits.

These results are supported by Roll and Wylie (2016), who explained that AI influences learning behaviors by providing immediate feedback and academic assistance, and Chen, Chen, and Lin (2020), who emphasized that intelligent educational technologies improve learning efficiency and independent study practices. However, the results also align with Selwyn (2019), who warned that excessive reliance on AI may affect critical thinking and independent learning skills. Similarly, Kasneci et al. (2023) noted that while AI enhances engagement and learning efficiency, improper use may lead to overdependence and reduced cognitive effort. These findings indicate that AI plays a significant role in shaping students' learning habits by improving engagement and efficiency, while also presenting challenges related to dependence, accessibility, and the development of critical thinking.

Table 1. 3. ***Students' perception of the effectiveness of AI in terms of learning habits***

Item	Description	Very Strongly Agree (5)	Very Agree (4)	Agree (3)	Slightly Agree (2)	Disagree (1)	Mean	Descriptive Interpretation
1	I have become more or over-reliant on AI that I could no longer think without its help	37	23	23	25	29	**3.10**	**Agree**
2	It is so costly because I cannot use it without paying for the internet	45	21	25	34	12	**3.39**	**Agree**
3	It is not helping much when it comes to critical thinking and decision-making because it lacks emotional engagement	24	22	23	33	35	**2.76**	**Agree**
4	AI use makes everything easier and faster, especially in my reading and performance	23	23	26	32	33	**2.79**	**Agree**
5	It is limited that sometimes I am not able to get the exact answer I am looking for because AI has its own limits	13	34	33	23	34	**2.77**	**Agree**
6	I've become more engaged with it that whenever we are not using it, my interest in learning decreases	33	35	21	22	26	**3.20**	**Agree**
7	I am tempted to launch other applications, like mobile games and social media, while we are having lectures in our class	19	34	33	26	25	**2.97**	**Agree**
Composite Mean:							**3.00**	**Agree**

Source of Data: *Data were obtained from the responses of 137 Grade 11 students from HUMSS, STEM, ABM, CGV, HRS, and ICT strands of Data Center College of the Philippines, Inc.- Laoag City, based on questionnaires administered on March 22, 2024.*

Summary of the students' perception of the effectiveness of AI

Table 4 presents a summary of students' perceptions of the effectiveness of artificial intelligence across classroom engagement, learning habits, and academic performance, with an overall mean of 3.00, interpreted as Agree, indicating that AI is generally perceived as effective in supporting students' learning experiences. Among the criteria indicators, classroom engagement obtained the highest mean of 3.02, followed by learning habits with a mean of 3.00, and academic performance with a mean of 2.88, all interpreted as Agree, suggesting that AI contributes positively to students' participation, study behaviors, and academic outcomes.

These results indicate that AI supports motivation, improves access to learning resources, and enhances students' ability to complete academic tasks efficiently. This is supported by Zawacki-Richter et al. (2019), who emphasized that AI improves learning effectiveness through personalized instruction and adaptive feedback, and Chen, Chen, and Lin (2020), who explained that intelligent educational technologies enhance academic performance and learning efficiency. Similarly, Crompton and Burke (2023) noted that AI-supported learning environments improve engagement and participation, while Bond et al. (2020) highlighted that educational technologies enhance learning effectiveness by providing accessible academic support and improving learning efficiency. These results indicate that AI plays an important role in enhancing classroom engagement, improving learning habits, and supporting academic performance, making it a valuable tool in modern educational environments.

Table 1. 4. ***Summary of students' perception of the effectiveness of AI***

Criteria indicators	Mean	Descriptive Interpretation
Effectiveness of AI in terms of classroom engagement	3.02	**Agree**
Effectiveness of AI in terms of classroom engagement	2.88	**Agree**
Effectiveness of AI in terms of academic performance	3.00	**Agree**
Total Mean	**3.00**	**Agree**

Source of Data: *Data were obtained from the responses of 137 Grade 11 students from the HUMSS, STEM, ABM, CGV, HRS, and ICT strands at Data Center College of the Philippines, Inc.-Laoag City, based on questionnaires administered on March 22, 2024.*

Problem 2: What are the outcomes of AI integration based on students' perception in terms of:

2.1. Changes in study habits or learning approaches;

2.2 Challenges and concerns experienced by the students?

2.1. Thematic analysis on the outcomes of AI integration based on students' perception in terms of changes in study habits or learning approaches

Table 7 highlights the outcomes of integrating artificial intelligence, including changes in students' study habits and learning approaches, revealing both positive and negative impacts. Under the theme *Transformative Enhancements in Study Practices and Learning Strategies*, the most frequent category was *Increased Productivity and Efficiency* (f = 7), indicating that AI helps students generate ideas, complete tasks more efficiently, and improve overall academic productivity. This was followed by *Access to Diverse Perspectives and Resources* (f = 6), showing that AI provides learners with broader access to information, supporting independent learning and expanding their understanding of academic topics. Additionally, *Enhanced Understanding of Complex Concepts* (f = 3) and *Improved Time Management Skills* (f = 3) suggest that AI helps students understand complex lessons and organize their academic responsibilities more effectively. These results support the study of Chen, Chen, and Lin (2020), who explained that AI enhances learning efficiency by providing adaptive instructional support and access to extensive educational resources, and Zawacki-Richter et al. (2019), who emphasized that

AI improves learning effectiveness through personalized instruction and real-time feedback. Similarly, Roll and Wylie (2016) noted that AI supports self-regulated learning by helping students monitor their progress and manage their learning more effectively. However, the theme *Emerging Risks in AI-Supported Learning Behaviors* also identified challenges associated with AI use. The category *Laziness and Dependency on AI* (f = 5) indicates that some students rely heavily on AI tools, which may reduce independent thinking and effort in completing academic tasks. Additionally, *Concerns about Academic Integrity and Plagiarism* (f = 2) suggest that some learners use AI-generated responses without fully understanding the material, potentially undermining academic honesty and cognitive development.

These concerns are supported by Selwyn (2019), who warned that excessive reliance on AI may negatively affect critical thinking and independent learning skills. Similarly, Kasneci et al. (2023) emphasized that while AI improves learning efficiency, improper use may lead to overdependence and academic integrity issues.

Overall, the thematic analysis indicates that AI integration contributes to improved productivity, access to information, and learning efficiency, while also presenting challenges related to dependency, academic integrity, and the development of independent learning.

Table 2.1. The outcomes of AI integration based on students' perception in terms of changes in study habits or learning approaches (N=20)

Theme	Category	Frequency (n)	Extracted statement of respondents
1. **Transformative enhancements in study practices and learning strategies**	Increased productivity and efficiency	7	*"My study habits became more productive as AI allows me to generate ideas to do all the tasks given to me." (R1)*
	Access to diverse perspectives and resources	6	*"The availability of vast amounts of information through AI platforms has allowed me to access diverse perspectives and resources efficiently." (R5)*
	Enhanced understanding of complex concepts	3	*"Through AI assistance, I access customized study materials that cater to my requirements" (R7)*
	Improved time management skills	3	*Since incorporating AI into my study routine, I have noticed a significant improvement in my time management skills. (R8)*
2. **Emerging risks in AI-supported learning behaviors**	Laziness and dependency on AI	5	*The changes are that students have become lazier, and some student who deserves the award of being an academic achiever doesn't get it*

			because of the students who use AI (R20)
	Concerns about academic integrity and plagiarism	2	*I have seen that some of my classmates use those generated answers as is. They do not try to understand the answer and use it as the basis for formulating their actual answer. (R15)*

Source of Data: *Data were derived from the open-ended questionnaire responses of 20 purposively selected Grade 11 students from various strands of Data Center College of the Philippines, collected on March 22, 2024.*

2.2. Thematic analysis on the outcomes of AI integration based on students' perception in terms of challenges and concerns experienced by the students

Table 6 presents the challenges and concerns students experience with the integration of artificial intelligence into learning, highlighting key themes of overreliance, ethical concerns, academic integrity, and technical limitations. Under the theme *Concerns about Over-Reliance on AI*, the category *Diminished Critical Thinking Skills* had the highest frequency (n = 8), followed by Decreased Interaction and Collaboration (n = 5), indicating that excessive reliance on AI may reduce students' ability to think independently and to actively engage in collaborative learning. These concerns suggest that while AI supports academic tasks, it may also affect cognitive development if not used responsibly. This aligns with Selwyn (2019), who emphasized that overreliance on AI can negatively affect learners' critical thinking and independent learning, and with Kasneci et al. (2023), who noted that excessive reliance on AI tools may reduce cognitive effort and problem-solving skills.

Under the theme *Ethical and Privacy Concerns*, the category *Data Privacy and Security* (n = 7) indicates that students are concerned about the safety of their personal information when using AI tools, while *Bias in AI Algorithms* (n = 3) reflects concerns about the accuracy and fairness of AI-generated responses. These concerns are supported by Holmes et al. (2019), who explained that ethical considerations, including data privacy and algorithm bias, are major challenges in AI integration in education. Similarly, UNESCO (2021) emphasized the importance of protecting students' data and ensuring responsible use of AI technologies in educational settings.

The theme *Academic Integrity and Plagiarism* also emerged as a significant concern, with *Misuse of AI-generated content* obtaining a frequency of (n = 6), indicating that some students use AI-generated answers without fully understanding the content. This raises concerns about academic honesty and the authenticity of learning. Kasneci et al. (2023) emphasized that improper use of AI tools may increase the risk of plagiarism and reduce genuine learning engagement.

Finally, under the theme *Technical Issues and Accessibility*, *Internet Connectivity Issues* obtained the highest frequency (n = 9), followed by *Risk of Scams or Data Breaches* (n = 6), indicating that technological limitations and security risks remain significant barriers to effective AI use. These

concerns are consistent with the findings of the World Bank (2020), which emphasized that technological accessibility and internet availability are critical factors influencing the effectiveness of digital learning tools. Overall, the thematic analysis indicates that while AI offers significant educational benefits, students also face challenges related to cognitive dependence, ethical concerns, academic integrity, and technological accessibility, underscoring the importance of responsible, balanced integration of AI in educational environments.

Table 2.2. ***The outcomes of AI integration based on students' perception in terms of challenges and concerns experienced by the students***

Theme	Category	Frequency (n)	Extracted statement of respondents
1. **Concerns about over-reliance on AI**	Diminished critical thinking skills	**8**	AI makes learning easier, but relying solely on it may limit students' practical skills and critical thinking
	Decreased interaction and collaboration	**5**	AI might minimize interaction and critical thinking abilities
2. **Ethical and privacy concerns**	Data privacy and security	**7**	I experienced getting nervous since I'm thinking about what if it is a scam or cookies that can access my personal info
	Bias in AI algorithms	**3**	I worry about becoming too reliant on AI and losing critical thinking and problem-solving skills
3. **Academic integrity and plagiarism**	Concerns about plagiarism and misuse of AI	**6**	A concern that I have encountered regarding the impact of AI is that some of my classmates use those generated answers as is
4. **Technical issues and accessibility**	Internet connectivity issues	**9**	When it was a pandemic, my academic engagement was low, having to be a top-notch, and then suddenly went down the rankings because of a poor internet connection in my barangay
	Risk of scams or data breaches	**6**	I experienced getting nervous since I'm thinking about what if it is a scam or cookies that can access my personal info

Source of Data: *Data were derived from the open-ended questionnaire responses of 20 purposively selected Grade 11 students from various strands of Data Center College of the Philippines, collected on March 22, 2024.*

Discussion

This study contributes to the growing body of literature on Artificial Intelligence (AI) integration in secondary education by providing localized empirical evidence from a Philippine Senior High School context. While previous studies focused primarily on higher education and technologically advanced

countries (Zawacki-Richter et al., 2019), this study demonstrates that AI integration in the classroom yields generally positive outcomes in classroom engagement, academic performance, and learning habits. The results suggest that AI serves as a supportive instructional tool that enhances students' motivation, productivity, and access to information, while complementing traditional teaching rather than replacing it.

From a theoretical perspective, the findings support the Technology Acceptance Model (TAM) and Self-Regulated Learning Theory. Students' agreement on AI's effectiveness confirms that perceived usefulness influences engagement and academic outcomes (Davis, 1989). Additionally, improvements in study efficiency and learning behaviors indicate that AI supports students' ability to regulate their learning (Zimmerman & Schunk, 2015). However, concerns about overreliance and diminished independent thinking highlight the need to balance technological support with guided instruction to ensure meaningful learning.

Practically, the results emphasize the importance of integrating AI strategically into instructional practices. Teachers play a critical role in guiding students to use AI responsibly as a learning support tool rather than as a substitute for critical thinking. Schools should provide guidance, establish AI usage policies, and support teachers through professional development to ensure effective implementation.

At the policy level, the findings highlight the need for institutional and national guidelines to address ethical use, academic integrity, accessibility, and data privacy. AI integration, when properly managed, can serve as a valuable educational tool to enhance engagement and academic outcomes. However, responsible implementation, proper guidance, and structured policies are essential to maximize its benefits and minimize potential risks.

Conclusion

This study concludes that integrating Artificial Intelligence (AI) into Senior High School education effectively enhances classroom engagement, academic performance, and learning habits. Students generally perceive AI as a supportive instructional tool that improves motivation, participation, study efficiency, confidence, and access to diverse learning resources. These findings affirm that AI serves as a complementary educational support system that enhances traditional teaching rather than replacing teachers in facilitating meaningful learning.

However, the study also identifies significant challenges, including overreliance on AI, concerns about reduced critical thinking, risks of plagiarism and academic integrity violations, data privacy issues, and limited internet access. These concerns indicate that while AI provides valuable instructional support, its integration must be carefully monitored to prevent student dependency and ensure the development of independent thinking and authentic learning.

Therefore, the study concludes that the effectiveness of AI in Senior High School education depends on responsible, ethical, and pedagogically guided implementation. Teachers play a crucial role in facilitating the appropriate use of AI to promote higher-order thinking skills, while educational

institutions must establish clear policies on academic integrity, data privacy, and equitable access to digital resources. With proper guidance, ethical safeguards, and institutional support, AI can serve as a strategic educational tool that enhances engagement, supports academic performance, and improves learning outcomes in the Philippine educational context.

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