

Investigating AI-Integrated Instruction in Improving Academic Performance of Senior High School Students in the Philippines

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Abstract: The innovation of Artificial Intelligence (AI) heralds a transformative shift in education. This study investigates the impact of integrating artificial intelligence (AI) on students' academic performance in a private Senior High School in the Philippines. This paper will utilize a quasi-experimental approach using a pretest-posttest design. The participants of this research are the Grade 11 students taking the Humanities and Social Sciences strand at Fervent Academy in Baas Pagsabungan, Mandaue City, Cebu, Philippines. This research highlights the integration of ChatGPT 3.5 in the interactive Q&A sessions during the formative assessment on Discipline and Ideas in the Social Sciences course. The study employed a 50-item examination designed for this course to assess the student's academic achievement. Moreover, The following presents the conclusions drawn from the findings of the study: (1) The study found that using AI ChatGPT 3.5 in formative assessment significantly improves students' academic performance; (2) ChatGPT 3.5 provides effective organization of concepts and information, thus, enhancing student and teacher engagement; (3) AI integration provides more profound knowledge and understanding based on students' learning styles; (4) To ensure effective AI integration, educators are recommended to address ethical concerns on data privacy and security, ensuring safety for both educators and students; (5) Furthermore, maintaining academic integrity is crucial for fairness and accountability.

Keywords: Artificial Intelligence in Education (AIED), Academic Achievement, ChatGPT 3.5, Social Studies, Senior High School

Introduction

Intelligence is universally acknowledged as a potent and significant element that has established humanity's dominance in various realms of existence. At present, we are undergoing a phase of extraordinary technological advancement driven by Artificial Intelligence, resulting in the emergence of countless unprecedented innovations. Moreover, the incorporation of artificial intelligence into several facets of education has become more widespread, potentially transforming teaching and learning methods (García-Martínez et al., 2023). Likewise, the field of AI in Education (AIED) has had significant expansion and advancement since the beginning of the 21st century (Holstein et al., 2019). However, on a broader level, educators and scholars have recently started exploring the potential pedagogical capabilities of AI apps to enhance students' academic achievement.

The field of education is undergoing continuous evolution and innovation. The implementation of

the K-12 education system in the Philippines in 2013 was a significant change that aimed to bring the country's educational system in line with global standards. This change was intended to improve the competitiveness of Filipino students on an international level (Department of Education, 2012). Moreover, the Senior High School (SHS) is a crucial component of the K-12 program, serving as the last two years. It offers students the opportunity to specialize in academic, technical-vocational, or arts and sports tracks, allowing them to tailor their education to their desired career paths (Canque et. al., 2021) In the Philippines, senior high school social studies are included to enhance students' understanding of historical, societal, and cultural processes. This component improves analytical and critical thinking skills, shaping future jobs in socio-political environments. The program covers Philippine history, government, economics, and international relations. However, poor academic performance in social studies is linked to traditional

teaching methods, which often lead to disengagement and insufficient engaging resources. Motivation, engagement, and personal learning pace can significantly increase academic achievement (Carredo et. al., 2022).

In this context, artificial intelligence (AI) technologies have emerged as a promising tool to develop teaching and learning experiences in social studies instruction. According to the study of Siemens & Baker (2012), AI innovations in online education, such as adaptive learning systems and personalized instruction, have significantly enhanced the learning experience. AI had now become unstoppable. Integrating AI comes with a comprehensive array of digital tools and resources available for educators and students in academic settings, encompassing collaborative tools, digital pinboards, e-learning applications, and lesson-planning tools. Thus, this marks the emergence of ChatGPT in education.

ChatGPT, a pioneering Generative Pre-trained Transformer developed by OpenAI, leverages transformer architecture to comprehend and generate human-like text responses. Through extensive pre-training on vast text datasets and subsequent fine-tuning for specific tasks, such as conversational dialogue, ChatGPT exhibits remarkable generative capabilities, producing contextually relevant responses to user input. Its interactive learning approach enables continuous adaptation and improvement based on conversational interactions, fostering more natural and engaging exchanges.

In Education, AI-powered systems can facilitate interactive engagement through conversational interactions, allowing students to ask questions, engage in discussions, and explore topics in depth. By fostering active participation and collaboration, ChatGPT promotes more profound understanding and critical thinking skills among students. Additionally, ChatGPT can offer personalized assistance to students by providing tailored explanations, feedback, and resources based on their individual learning needs and preferences. Whether it is clarifying concepts, answering questions, or providing additional practice materials, ChatGPT can adapt to each student's pace and learning style (González-Brenes et. al., 2018)

With AI growing to be an unlimited and potent weapon, our work aims to address the following questions: Can senior high school social studies students do better academically with AI-assisted learning instruction? Moreover, the researchers think that more research is needed to deal with the developing issues of artificial intelligence with regard to maintaining academic integrity, safety and data protection, and ethical issues. In order to effectively utilize the advantages of AI technologies for both teachers and students, this paper attempts to clarify the literature assessing their ethical and practical integration into the educational system.

Methods and Materials

This study will utilize a quasi-experimental approach with a pretest-posttest design to explore the potential of AI-assisted instruction on the academic achievement of senior high school students. The participants of this study are Grade 11 students taking Humanities and Social Sciences strand at Fervent Academy in Baas Pagsabungan, Mandaue City, Cebu, Philippines. The study highlights the integration of ChatGPT 3.5 in interactive Q&A sessions during the formative assessment. The teacher as the facilitator conducts his lesson in the 4th quarter of the Disciplines and Ideas in Social Sciences. Students will be guided to prompt questions using the ChatGPT 3.5 to ask follow-up questions, clarify concepts, and research further information.

The experimental group will be given both pretest and post-test assessments to evaluate their academic improvement. The data from the test were analyzed using SPSS software. Descriptive statistics such as mean and standard deviation will provide insight into students' academic achievement. Inferential statistical analysis of data will be employed using a t-test to determine the significant differences the students' test scores. Furthermore, the researchers aim that through the findings of this paper can contribute relevant recommendations to the school on the integration of Artificial Intelligence in social studies instruction.

Ethical Considerations

The researchers presented informed consent from both the students and their guardians to ensure their voluntary and active participation in the

research. Before the intervention of the study was conducted, the students of Grade 11 HUMSS at Fervent Academy were given clear objectives, procedures, and safety protocols to ensure a safe and conducive learning environment. Additionally, the researchers primarily submitted a permit letter to the school administrator and had been granted permission to conduct the research in the classroom and the students as its participants. The data obtained during the research, mainly the pretest and the posttest scores of the students, were treated with utmost respect and were safely stored to protect the data of the participants. Furthermore, responsibility with integrity is the core of this research.

Results and Discussion

This section presents the analysis and findings of the study. Table 1 displays the descriptive statistics of the pretest and post-test scores of students. Table 2 further analyzes the inferential statistics determining the differences of the pretest and post-test results.

Table 1: Pretest Scores and Post-test Scores

POST-TEST SCORES	PRETEST SCORES	
40	40	N
34	20	Minimum
50	38	Maximum
43.4250	29.2500	Mean
3.76739	5.58271	SD

Table 1 presents the mean scores and standard deviations for the pretest and post-test assessments of the students. The data indicates a significant improvement in scores, with mean scores increasing from 29.25 in the pretest to 43.425 in the post-test.

During formative assessment, students used ChatGPT to ask follow-up questions, helping them understand and retain the material better, as shown by their higher scores on their post-test. According to D'Mello et al., (2017), personalization is critical in educational technology because it suggests which tool effectively adapts to learners' cognitive and emotional states, which significantly

could improve their learning outcomes. By actively engaging with ChatGPT in Q&A sessions, students could clarify immediate doubts post-lesson and engage in deeper, critical thinking about the subject matter. Consequently, this continual interactive feedback loop contributed to stronger knowledge retention.

Table 2: The comparison of the Pretest Score and the Post-test Scores

POST-TEST	PRETEST SCORES	
43.4250	29.2500	Mean
3.76739	5.58271	SD
	-12.920	T
	39	DF
	.000	P-Value
	Reject the null hypothesis	Decision
	Significant Difference	Interpretation

As illustrated in Table 2, the data indicates a significant improvement in the student's post-test scores compared to their pretest scores. This indicates the effectiveness of ChatGPT as a dynamic tool.

It is recognized that as technology advances, educators constantly develop and refine virtual teaching strategies to better integrate technology into instruction. (Abojon et. al., 2023; Derasin et. al., 2021; Canque et. al., 2021; Canque et. al., 2023; Ortiz et. al., 2023; Medico et. al., 2023; Cantago et. al., 2023, Romeo et. al., 2023). Artificial Intelligence (AI) is transforming multiple sectors, mainly education. These new technologies revolutionize the way students learn through personalized and interactive learning experiences— and immediate feedback, which significantly improved students' academic performance (Pane et al., 2017). Additionally, AI technologies can offer valuable insights into student performance and learning styles, thus allowing educators to make informed academic decisions. Through this innovation, it directly assesses the learning outcomes and improves curriculum design, and teaching techniques (Jia & He, 2022; Rahim et al., 2018).

Notably, the researchers infer that integrating AI into education can offer significant efficiency and favorable benefits, however, it also posits various challenges that must be actively addressed to ensure its effective and ethical implementation in education. Among these is the need for modern and advanced infrastructure, which includes high-speed internet and computing resources; however, not all schools have access and capacity (Helbing, 2019). Additionally, further research supports that the integration of AI into the curriculum could prompt critical concerns, mainly regarding data privacy, security, and academic integrity (Cath, 2018; Taihagh, 2021). Moreover, relevant concerns on student's socioeconomic disparities became prevalent, barring them from accessing technology of Artificial Intelligence in the classroom. This unequal access to technology, coupled with poor teacher and student digital literacy, contradicts the DepEd's goal of accessible and inclusive education. This study suggests that teachers should create inventive and captivating activities that incorporate the use of Artificial Intelligence capabilities into the learning curriculum. By employing AI strategically, educators can greatly raise students' level of involvement and enhance their academic success. More precisely, the incorporation of AI is customized to accommodate the diverse learning styles and speeds of individual students, so enabling an engaging and individualized learning encounter. The researchers strongly advocate for the active involvement of key stakeholders, such as educators, school administrators, students, and policymakers, in exploring the capacity of AI to offer dynamic and interactive experiences that enable students to generate outputs and, consequently, enhance their critical thinking and problem-solving abilities. Overall, the deliberate integration of AI enhances students' scholastic achievements and prepares them with the proficient expertise and abilities necessary to effectively utilize and navigate through an expanding digital realm.

Conclusion

The study demonstrates that AI ChatGPT 3.5 improves students' academic performance by utilizing formative assessment, fosters greater engagement between teachers and students, and facilitates more profound learning. However, it also

raises ethical concerns around data privacy and security. Given the ongoing advancements in technology, educators and legislators must set clear standards and legislation to safeguard the sensitive information of children. Furthermore, continuous study and monitoring are imperative to guarantee the responsible utilization of AI ChatGPT 3.5 in educational environments. Ensuring a harmonious equilibrium between the advantages of AI technology in education and its potential hazards is crucial. Educators need to receive training on properly integrating AI technologies into their teaching methods while ensuring student data protection.

References

- [1] Abojon, J. A., Derasin, L. M. C., Canque, M. S., Cordero, L. S., & Trinidad, G. A. (2023). Technological Skills of Senior High School Students in State-Run Basic Education Institutions in the Philippines. *European Chemical Bulletin*, 12(Special Issue 4), 12510-12518
- [2] Anderson, K., & Kahveci, M. (2019). Factors Contributing to Students' Poor Performance in Social Studies. *European Journal of Educational Research*, 8(1), 165-177.
- [3] Artificial Intelligence Innovations in Online Learning. Retrieved from <https://www.onlineeducation.com/features/ai-in-distance-learning>
- [4] Ashok, M., Madan, R., Joha, A., & Sivarajah, U. (2022). Ethical framework for Artificial Intelligence and Digital technologies. *International Journal of Information Management*, 62, 102433. <https://doi.org/10.1016/j.ijinfomgt.2021.102433>
- [5] Birch, J., & Lubienski, C. (2019). The Impact of Pedagogical Approaches on Student Engagement in Social Studies Classrooms. *Journal of Social Studies Education Research*, 10(2), 45-59.
- [6] Borenstein, J., & Howard, A. (2021). Emerging challenges in AI and the need for AI ethics education. *AI and Ethics*, 1(1), 61–65. <https://doi.org/10.1007/s43681-020-00002-7>
- [7] Borenstein, J., & Howard, A. (2021). Emerging challenges in AI and the need for AI ethics

- education. *AI and Ethics*, 1(1), 61–65. <https://doi.org/10.1007/s43681-020-00002-7>
- [8] Cath, C. (2018). Governing artificial intelligence: ethical, legal and technical opportunities and challenges. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 376(2133), 20180080.
- [9] Canque, M. S., Derasin, L. M. C., & Pinatil, L. L. (2021). Senior High School Background and GPA of the Education Students in a State University in the Philippines. *Turkish Journal of Computer and Mathematics Education*, 12(13), 3560-3566.
- [10] Canque, M. S., Derasin, L. M. C., Cortez, J. A., & Gamboa, F. V. A. (2021). Microprocessor Course in a Virtual Classroom Perspectives from Technology Students in a State University in the Philippines. *Turkish Online Journal of Qualitative Inquiry*, 12(7).
- [11] Canque, M. S., Cordero, L. S., Derasin, L. M. C., & Pinatil, L. L. (2023). Resumption of in-Person Classes in the State-Run Basic Education Institutions in the Philippines: Lived Experience of Filipino Junior High School Students. *Telematique*, 22(01), 495-503.
- [12] Cantago, C. K. C., Lanás, C. A., Traveró, K. M., & Derasin, L. M. C. (2024). Investigating the Role of Digital Storytelling in Enhancing Reading Comprehension of Senior High School Students in the Philippines. *Journal of Harbin Engineering University*, 45(2).
- [13] Carredo, G., Delgado, M. J., Dragas, F., Rasco, A. M., & Derasin, L. M. (2022). Effect of Learners' Level of Motivation in Developing Their Study Habits Amid the Pandemic. *International Journal of Science and Management Studies*, 5(4), 64-72.
- [14] Derasin, L. M. C., Canque, M. S., Horteza, A. D., & Jungoy, E. E. (2021). Virtual Learning In A State University In The Philippines: Perspectives From The Education Students. *Multicultural Education*, 7(10).
- [15] D'Mello, S., Dieterle, E., & Duckworth, A. (2017). Advanced, analytic, automated (AAA) measurement of engagement during learning. *Educational Psychologist*, 52(2), 104–123.
- [16] Fahimirad, M., & Kotamjani, S. S. (2018). A review on application of artificial intelligence in teaching and learning in educational contexts. *International Journal of Learning and Development*, 8(4), 106-118.
- [17] Faiz, M., & Avci, E. K. (2020). Academic motivation levels of secondary school students and their attitudes towards a social studies course. *Review of International Geographical Education Online*, 10(2), 156-185.
- [18] Fernández, C., Massey, G. C., & Dornbusch, S. M. (1976). High school students' perceptions of social studies. *The Social Studies*, 67(2), 51-57.
- [19] García-Martínez, I., Batanero, J. M. F., Fernández-Cerero, J., & León, S. P. (2023, January 15). Analysing the Impact of Artificial Intelligence and Computational Sciences on Student Performance: Systematic Review and Meta-analysis. *University of Alicante*, 12(1), 171-171
- [20] González-Brenes, J. P., Huang, Y., & Brusilovsky, P. (2018). Personalized Education at Scale: AI-Powered Adaptive Learning and Its Impact on Student Outcomes. *IEEE Transactions on Learning Technologies*, 11(2), 240-253.
- [21] Helbing, D. (2019). Societal, economic, ethical and legal challenges of the digital revolution: From big data to deep learning, artificial intelligence, and manipulative technologies. In Helbing D. (ed) *Towards digital enlightenment* (pp. 47–72). Cham: Springer. https://doi.org/10.1007/978-3-319-90869-4_6
- [22] Holstein, K., McLaren, B. M., & Alevin, V. (2019). Designing for Complementarity: Teacher and Student Needs for Orchestration Support in AI-enhanced Classrooms *International Journal of Artificial Intelligence in Education*, 29(2), 243-259.
- [23] Jia, J., & He, Y. (2022). The design, implementation, and pilot application of an intelligent online proctoring system for online exams. *Interactive Technology and Smart Education*, 19(1), 112–120. <https://doi.org/10.1108/ITSE-12-2020-0246>

- [24] Khosrow-Pour, D. B. A. (Ed.). (2020). *Handbook of research on modern educational technologies, applications, and management*. IGI Global.
- [25] Medico, J. O., Nepangue, D. S., & Derasin, L. M. C. (2023). The Impact Of Digital Gamification And Traditional Based Learning On Students' mathematics Achievement: Evidence From The Philippines. *Journal of Data Acquisition and Processing*, 38(4), 2108.
- [26] Miao, F., Holmes, W., Huang, R., & Zhang, H. (2021). AI and education: Guidance for policymakers. United Nations Educational, Scientific and Cultural Organization. <https://unesdoc.unesco.org/ark:/48223/pf0000376709>
- [27] National Council for the Social Studies. (2013). College, career, and civic life (C3) framework for social studies state standards.
- [28] National Economic and Development Authority (NEDA). (2016). *Ambisyon Natin 2040*. Retrieved from <https://www.neda.gov.ph/ambisyon-natin-2040/>
- [29] National Governors Association Center for Best Practices. (2010). Common Core State Standards: High school graduation requirements.
- [30] National Research Council. (2012). Education for life and work: Developing transferable knowledge and skills in the 21st century. The National Academies Press.
- [31] Nguyen, A., Ngo, H. N., Hong, Y., Dang, B., & Nguyen, B. P. T. (2023). Ethical principles for artificial intelligence in education. *Education and Information Technologies*, 28(4), 4221-4241.
- [32] Official Gazette of the Republic of the Philippines. (2013). *Enhanced Basic Education Act of 2013*. Retrieved from <https://www.officialgazette.gov.ph/2013/05/15/republic-act-no-10533/>
- [33] Official Gazette of the Republic of the Philippines. (2013). *Enhanced Basic Education Act of 2013*. <https://www.officialgazette.gov.ph>
- [34] Online education in the post-COVID era. (2021). Nature Electronics. Retrieved from <https://www.nature.com/articles/s41928-020-00534-0>
- [35] Ortiz, P. M. M., Tagayong, L. V., & Derasin, L. M. C. (2023). Mobile Phone Dependence among Junior High School Students in Public Schools in the Philippines. *International Journal of Science and Management Studies (IJSMS)*. 6(3), 124 - 130
- [36] Pane, J. F., Steiner, E. D., Baird, M. D., & Hamilton, L. S. (2017). Continued Progress: Promising Evidence on Personalized Learning. RAND Corporation.
- [37] Popenici, S. A., & Kerr, S. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. *Research and practice in technology enhanced learning*, 12(1), 22.
- [38] Rahim, T. N. T. A., Aziz, Z. A., Rauf, R. H. A., & Shamsudin, N. (2018). Automated exam question generator using genetic algorithm. 2017 IEEE Conference on e-Learning, e-Management and e-Services, IC3e 2017
- [39] Romeo, A. Q., Gomez, G. P., Bontia, L. C., Alvarado, J. R., & Derasin, L. M. C. (2023). The Return of In-person Classes in the State-Run Basic Education Institutions in the Philippines: Viewpoints of Teachers Working in Remote Locations. *SJIS-P*, 35(3), 399-404.
- [40] Siemens, G., & Baker, R. S. D. (2012, April). Learning analytics and educational data mining: towards communication and collaboration. In *Proceedings of the 2nd international conference on learning analytics and knowledge* (pp. 252-254).
- [41] Shelton, C., & Archambault, L. (2019). The Impact of Digital Tools on Teaching and Learning in Social Studies Education. *Journal of Digital Learning in Teacher Education*, 35(3), 127-135.
- [42] Southeast Asian Ministers of Education Organization (SEAMEO INNOTECH). (2015). *Guidebook to the K to 12 Curriculum*. Retrieved from <https://www.seameo-innotech.org>
- [43] Taeihagh, A. (2021). Governance of artificial intelligence. *Policy and Society*, 40(2), 137–157. <https://doi.org/10.1080/14494035.2021.1928377>