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Quantifying NSHS Students' Engagement: Assessing the Efficacy of Language Model Generative AI in Educational Research

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Abstract

The study, "Quantifying NSHS Engagement: Assessing the Efficacy of Language Model Generative AI in Educational Research," seeks to determine the link between students' Behavioral, Emotional, Cognitive, and Social engagement and exposure to ChatGPT. Bard, and Grammarly. Moreover, it aims to provide information about the efficacy of AI technology. A correlational research design measures students' engagement level toward Language Model Generative AI (LMGAI). It identifies the relationship between students' engagement and exposure to Language Model Generative AI (LMGAI) in educational research without causation. This study covers one hundred (100) Noveleta Senior High School students. Researchers used a heuristic method for correlational study to select the number of participants. Samples are drawn from populations that utilized Language Model Generative AI in their research regardless of age, grade level, and gender. The researchers employed a non-random purposive sampling technique. Based on the study's findings, the student's behavioral, emotional, cognitive, and social engagement is at mid-level with an average mean of ($\bar{x}$=3.04). Moreover, their exposure to ChatGPT, Bard, and Grammarly is at mid-level with an average mean of ($\bar{x}$=2.87). Finally, using the Spearman Correlation Correlation Coefficient, the researchers found a "very strong positive relationship" between students' behavioral, emotional, cognitive, and social engagement and ChatGPT, Bard, and Grammarly.

Keywords: NSHS, Language Model Generative AI (LMGAI), ChatGPT, Philippines

Introduction

In today's world, students have come to depend heavily on technology for carrying out academic tasks and assignments. Technology's convenience and ease of use have made it the preferred choice for students when researching or gathering information. With just a few mouse clicks, students can effortlessly explore vast amounts of information available on the internet, rather than having to physically flip through pages of books, which can be both time-consuming and tedious. The approach to learning has been transformed by technology, making it more accessible and efficient for students everywhere.

The Internet is highly significant in learning. Today's generation is engaging more on Google and other search engines for their queries and hesitancy (Kajal, 2023) [37]. In 2023, more than 5.3 billion people are using the Internet actively, making up 65.4% of the human population worldwide (Shewale, 2023) [60]. As students continue to rely on technology for their academic tasks and assignments, they become more engaged with AI tools. Artificial Intelligence refers to the ability of computers to perform cognitive tasks often associated with human minds (Baker, 2019) [6]. These tasks primarily involve learning and problem-solving. Artificial Intelligence can do tasks much quicker than Human Intelligence (Teng, 2019) [65].

Psychologists understand human intelligence as a combination of various distinct abilities rather than being defined by a single trait. There has been a primary emphasis on analyzing particular intelligence components in artificial intelligence (AI). These components include but are not limited to learning, reasoning, problem-solving, perception, and language utilization (Copeland, 2023) [15].

Consequently, despite advancements in AI research, the development of programs that possess comprehensive human-like adaptability across diverse domains or excel in tasks demanding extensive everyday knowledge is yet to be achieved. ChatGPT is the most relevant artificial intelligence tool at this juncture. The website has over 100 million users. In June 2023, it was visited 1.6 billion times. It has outperformed Instagram, which achieved 1 million downloads in just 2.5 months, whereas

Netflix took over 3.5 years to reach the same number of users (Duarte, 2023) [21]. Student engagement in AI tools is increasing as technology continues to advance. According to Nietzel (2023) [49], approximately 20% of college students have acknowledged their utilization of artificial intelligence (AI) to fulfill their academic tasks. Most students who have resorted to AI applications reported employing them for personal endeavors, driven by their curiosity, or for recreational purposes. However, Dignum (2021) [19] emphasizes that artificial intelligence has a wide range of effects on education.

A type of artificial intelligence called language model generative AI (LMGAI) may produce natural language writings in response to inputs like a prompt, a keyword, or a context. People use Language Model Generative AI (LMGAI) for tasks such as question answering, text summarization, conversation building, and content creation. However, there may be ethical and social concerns with using language model generative AI (LMGAI) in research and education, and the reliability and quality of the generated texts are only sometimes assured (Miao *et al*., 2023). This framework is used to assess the effectiveness of LMGAI regarding its technical quality and pedagogical impact across various topics, contexts, and scenarios related to education research. Doing so may help determine the strengths and weaknesses of LMGAI and its potential and challenges for future development and application (Brown *et al*., 2020).

Using a framework that considers both technical and pedagogical aspects in the development of texts is an approach that can be used to assess the efficacy of LMGAI in educational research. The technical aspect includes the accuracy, coherence, relevance, and authenticity of the texts, as the pedagogical aspects are those related to learning results, engagement, motivation, and feedback from students or researchers who use or interact with them (Katz *et al*., 2023) The technical element can be assessed using various techniques, including hybrid, automated, and human evaluation. Human evaluation is known as asking experts or peers to grade or remark on the quality of the generated texts using predetermined standards. Automatic evaluation entails comparing the generated texts to reference texts or other sources of information using computational metrics or algorithms. Hybrid evaluation combines human and machine methods to produce a more thorough and balanced review (Liu *et al*. 2019).

Adapting to changing demands requires innovation and creativity in education. Education leverages Artificial Intelligence (AI) to facilitate teaching and learning. AI in education has numerous applications, such as virtual mentors, voice assistants like Siri or Google Assistant, innovative content, presentation translators, global online courses like MOOCs, automatic assessment, personalized learning platforms, educational games, and intelligent tutoring systems (Fitria, 2021) [22]. With the progression of artificial intelligence (AI) and natural language processing, various web-based writing tools have been developed. These tools, powered by AI, allow students to perform tasks such as text translation, spelling improvement, text rewriting, and text summarization. The findings from the study indicate that students hold diverse perspectives on AI-powered writing tools. Some students utilize these tools without critical analysis or skepticism, which may inadvertently result in plagiarism.

On the other hand, certain students may refrain from using such writing tools due to skepticism and a potential lack of effective learning strategies (Burkhard, 2022). The role of Artificial Intelligence (AI) technology is becoming more visible in a variety of fields. Education is one of these areas. The emergence of AI technology has impacted the educational curriculum, particularly in technology, science, mathematics, and engineering. AI technology is set to transform the future of education (Fitria, 2021b) [23].

Artificial intelligence efficiently organizes study schedules and assignments or writes a research paper. It helps the student to save valuable time and effort (Siingh, 2023). GPT-3, OpenAI's third edition, anticipates the writer's ideas. Entering the primary concept of what will be written in that app creates an essay or any writing-related content that is not pirated from other people's work. It was written freshly like an original work. One of the reasons plagiarism checkers cannot detect it (Anson, 2022). Moreover, another study stated that AI technology is also allegedly said to be causing the introduction of new means of plagiarism (Fitria, 2021) [22]. This tool can paraphrase the original material, alter conjunctions, and so on without compromising the meaning, and make it look like the original work.

A recent study has explored the impact of AI on student engagement and academic achievement, with a particular focus on high schools. The research findings suggest that the effectiveness of AI in the classroom depends heavily on how it is integrated. The study indicates that students can benefit from AI tools when they can interact with them and control their learning pace. This emphasizes the significance of interactive, hands-on AI tools to effectively engage high school students (Alquraini & Abdullah, 2023).

Luckin & Holmes (2019) stated that the focus is on AI's capacity to personalize learning and provide feedback. Their work emphasizes that AI is already actively used in education, including in tutoring systems and intelligent textbooks. The review provides valuable insights into how AI is transforming educational practices. The utilization of AI has the capability to improve the efficiency and effectiveness of educational delivery significantly.

By recognizing these results, further studies are needed to identify whether the efficacy of language model generative AI in writing increases the level of students' engagement. Consequently, the primary objective of the present study is to gauge the level of engagement exhibited by students when employing language model generative AI in their educational research. Conducting this research will help provide information about the efficacy of AI-driven tools in educational research and its relationship with students' level of engagement.

Objectives of the Study

This study aims to determine the students' level of engagement and assess the efficacy of language model generative AI in Noveleta Senior High School students. Specifically, it aims to (1) determine the relationship between Behavioral, Cognitive, Emotional, and Social engagement in Language Model Generative AI; (2) assess the efficacy of ChatGPT, Bard, and Grammarly in educational research.

Methods and Materials

The researchers employ the quantitative approach utilizing correlational techniques to measure students' engagement

level toward Language Model Generative AI (LMGAI) and identify the relationship between students' engagement and exposure to Language Model Generative AI (LMGAI) in educational research without causation. The analysis of data, statistics, computing tools, and analysis is the foundation of quantitative research, as stated by Adedoyin (2020). Quantitative research employs the positivist paradigm, which advocates for statistical techniques such as mathematical inferential statistics, hypothesis testing, exposition, and surveys with limited predetermined answers (Adedoyin, 2020).

The purpose of conducting correlation research is to determine the connection between two closely connected tendencies, how they influence each other, and the resulting variations. This method of quantitative research is employed to evaluate inherent relationships, and it requires the participation of at least two distinct groups of researchers to be effective. Establishing a relationship between two groups or entities is necessary without assuming any particulars. In a correlational research design, the researcher does not control or manipulate the variables but rather examines their relationships. The correlation reflects the strength and direction of two or more variables concerning each other. There may be a positive or negative direction for the correlation Bhandari (2021).

Furthermore, correlational research is a type of research that does not involve experiments. Instead, it focuses on measuring two variables and evaluating their statistical relationship. The researcher ensures no influence from any extraneous variable while carrying out the assessment. In statistical analysis, it is necessary to distinguish between categorical and numerical data, since they contain distinct categories or labels. In contrast, numerical data contain measurable quantities as stated by Fleetwood (2024).

This study covers one hundred (100) Noveleta Senior High School students. Researchers used a heuristic method for correlational study to select the number of participants. Samples are specifically chosen from populations that utilized Language Model Generative AI in their research regardless of age, grade level, and gender. The researchers employed a non-random purposive sampling technique.

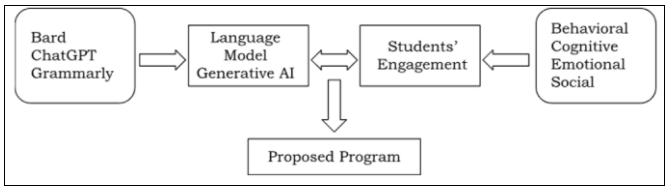

Fig 1: Conceptual Framework of the Study

The researchers obtained a questionnaire for the respondents once conducted at Noveleta Senior High School. This study will be participated in by 100 respondents, composed of Noveleta Senior High School students. The researchers will use the Likert Scale as their main questionnaire. According to Taherdoost (2020), the Likert Scale is used in different research fields, including sociology, and more. Thus, this indicates the validity and convenience of the Likert Scale; by using the 5-point Likert Scale, the respondents can easily understand and facilitate the questionnaire. Therefore, the researchers decided to use this type of questionnaire. The researchers generated fourteen (14) questions based on previous studies about students' engagement, specifically cognitive, behavioral, emotional, and social engagement. To check the validity of the questionnaire, the research adviser checks the questions to see if they are related to the statement of the problem and research design. For the consent letter approval, the school head checks both the questionnaire and consent letter containing the potential risks of answering the questionnaire and terms of data and privacy. The researcher used a Google Forms online survey form. The researchers used Google Forms for faster and cheaper data collection. According to Chernikov (2023) [14], Google Forms is an efficient tool for creating surveys, so for convenient access on students' mobile devices, the researchers encoded the survey items in Google Forms.

The students' engagement toward Language Model Generative AI is analyzed using the Spearman Rank Correlation Coefficient and the efficacy of Language Model Generative AI in educational research using descriptive statistics. The correlation coefficient is a straightforward measure of dependence between variables comparable to classical coefficients like Pearson's or Spearman's (Sourav, 2020) [62]. *Descriptive statistics* is a method used to summarize and describe the essential characteristics of a dataset. It helps understand the data by providing valuable insights such as measures of central tendency, variability, and distribution.

Results and Discussion

In this chapter, the researchers discussed and analyzed the results of the data gathered through questionnaires. It is divided into two parts: (1) analysis for descriptive; and (2) analysis for correlation. The quantitative data are generated using Jamovi to quantify the engagement level of students in terms of Behavioral, Emotional, Cognitive, and Social to Language Model Generative AI, specifically, ChatGPT, Bard, and Grammarly.

Problem 1: *What is the student's level of engagement in using Language Model Generative AI among NSHS students in terms of behavioral, emotional, cognitive, and social aspects?*

Table 1.1: Students Level of Behavioral Engagement

Questions	***Weighted Mean***	***Interpretation***
I make it a habit to review my research work generated with AI for any errors or inconsistencies.	2.86	Mid
I put in a significant effort to excel in my research projects using Language Model Generative AI.	2.87	Mid
When I am into difficult research issues, I keep working on them using LMGAI until I think I have solved them.	3.23	Mid
Total Average	2.99	Mid

Table 1.1 illustrates students' behavioral engagement with Language Model Generative AI. The study reveals that their behavioral engagement is infrequent, denoted as "mid," with an average mean of ($\bar{x}$=2.99). The initial hypothesis suggested that increased Language Model Generative AI usage would lead to higher behavioral engagement. However, the collected data indicates that students seldom interact with the AI tool, reflecting a middle level of engagement.

Based on the study's findings, students rarely put a significant effort into overcoming their research issues using

Language Model Generative AI. They barely habitually review their research with AI for any inconsistencies. Moreover, they rarely put in a significant effort to excel in the research projects using Language Model Generative AI. Consequently, students show minimal effort in utilizing and reviewing their research with language model generative AI, signifying a lack of behavioral engagement in Language Model Generative AI. In contrast with the study of Alzahrani (2023) which stated that AI technology is very useful in influencing people's behaviors.

Table 1.2: Students' Level of Emotional Engagement

Questions	*Weighted Mean*	*Interpretation*
The use of Language Model Generative AI in my research brings me happiness and satisfaction.	2.98	Mid
I talk with people outside of school about the help of language model generative AI in my research.	2.77	Low
I like using language model generative AI in research.	2.85	Mid
Exploring research with Language Model Generative AI makes the process enjoyable and engaging for me.	3.04	
Total Average	2.91	Mid

Table 1.2 illustrates students' emotional engagement with Language Model Generative AI (LMGAI). The study reveals that their emotional engagement level is infrequent, categorized as "mid" with an average mean of ($\bar{x}$=2.91). The hypothesis suggested that increased satisfaction with the language model would result in higher emotional engagement. The use of Language Model Generative AI in their research rarely brings them happiness and satisfaction, and they did not find exploring research with AI enjoyable and engaging them. Despite that, it reveals the mid-engagement of students.

The research findings indicate that students are not that satisfied with the use of Language Model Generative AI in their research, suggesting a mid-level of emotional engagement. Students' low satisfaction with Language Model Generative AI signifies low emotional engagement. In contrast, the recent study of Pantano & Scarpi (2022) [51] found that consumers have diverse emotions when interacting with AI, ranging from positive to negative. Additionally, consumers may form an emotional connection with AI and plan to use it again in the future.

Table 1.3: Students Level of Cognitive Engagement

Questions	*Weighted Mean*	*Interpretation*
When learning new information with a language model generative AI, I make an effort to express my thoughts using my own vocabulary.	3.21	Mid
When utilizing Language Model Generative AI in research, I enhance my understanding by connecting new information with what I already know.	3.15	Mid
I try to see the similarities and differences between the information I learn through language model generative AI and things I know already.	3.17	Mid
I try to match what I already know with things I am trying to learn with Language Model Generative AI regarding research.	2.97	Mid
Total Average	3.12	Mid

Table 1.3 illustrates students' cognitive engagement with Language Model Generative AI (LMGAI). The study reveals that their engagement is infrequent, categorized explicitly as "mid" with an average mean of ($\bar{x}$=3.12). Students rarely try to see the similarities and differences between the information they learn through language model generative AI and things they know already and rarely put their ideas in their own words when learning new information.

Despite the hypothesis proposing that more knowledge about language models would lead to increased cognitive engagement, the research findings suggest that students rarely gain new insights from LMGAI, suggesting mid-level of cognitive engagement. The perception of Language Model Generative AI's inefficacy among students signifies the overall mid-level cognitive engagement. This is in contrast with the study of Liang *et al*. (2023). As they believe in their ability to succeed, they tend to show more interest in learning activities and are thus more inclined to invest effort in exploring and understanding knowledge. This, in turn, leads to an increase in cognitive engagement.

Table 1.4: Students' Level of Social Engagement

Questions	*Weighted Mean*	*Interpretation*
I find that having similar work attitudes in using language model AI for research boosts collaboration and social engagement with my colleagues.	3.11	Mid
Our shared work goals, like publishing high-quality research, strengthen my social engagement when I use language model AI for my academic work.	2.99	Mid
I believe that agreeing on work values, such as transparency and responsible AI use, is essential for ethical practices and enhances my social engagement in research.	3.12	Mid
Total Average	3.07	Mid

Table 1.4 illustrates the extent of students' social engagement with Language Model Generative AI (LMGAI). The study reveals infrequent engagement, categorized explicitly as "rarely," with an average mean of ($\bar{x}$=3.07). Students barely believe that agreeing on work values, such as transparency and responsible AI use, is essential for ethical practices and enhances my social engagement in research. In addition, students shared work goals like publishing high-quality research when utilizing Language Model Generative AI in their research, rarely boosting their social engagement.

Despite the hypothesis proposing that a shared perception regarding the use of Language Model Generative AI could enhance students' social engagement, the research findings indicate that students rarely collaborate or share work goals with their colleagues in the context of AI, suggesting a low level of social engagement. This contrast to the study of Verna *et al*. (2023) indicates that developing and applying AI tools in education can indirectly influence how students socially engage with educational content, teachers, and the learning environment.

Table 1.5: Student Engagement on Language Model Generative AI

Factors	*Weighted Mean*	*Interpretation*
Behavioral Engagement	2.99	Mid
Emotional Engagement	2.91	Mid
Cognitive Engagement	3.12	Mid
Social Engagement	3.07	Mid
Total Average	3.04	Mid

Table 1.5 illustrates the exposure of students to Language Model Generative AI in research. The study indicates that students infrequently employed ChatGPT in their research, specifically categorized as "mid" with an average mean of ($\bar{x}$=2.8). This supports the claim of Bhosale (2023) who states that many academics are concerned that ChatGPT would make plagiarism more prevalent and provide less monitoring of research and writing ethics. Additionally, the widespread use of ChatGPT can have negative consequences, such as encouraging plagiarism and fostering dependency on machines among researchers and students, resulting in decreased self-sufficiency and increased laziness (Qasem, 2023). These concerns lead to low exposure of the students. In addition, the results showed that students infrequently employed Bard in their research, specifically categorized as "mid" with an average mean of ($\bar{x}$=2.55). This supports the claim of Ivankov (2023), which indicates that Google Bard's use of artificial intelligence is raising some concerns, leading to low exposure. Moreover, students infrequently employed Grammarly in their research, specifically categorized as "mid" with an average mean of ($\bar{x}$=3.26). This supports the claim of Javier (2022), who says Grammarly has been found useful for academic writing. Because of its usefulness and convenience, students are positive about Grammarly. In addition, Grammarly has been an effective tool for checking grammar errors and possible style flaws (Huang, 2020).

Problem 2: *Is there a significant relationship between students' engagement and exposure to language model generative AI?*

Table 2: Spearman Correlation Coefficient Table

	Behavioral		Emotional		Cognitive		Social		ChatGPT		Bard		Grammarly
Behavioral	—												
Emotional	0.976	***	—										
Cognitive	0.970	***	0.971	***	—								
Social	0.960	***	0.973	***	0.978	***	—						
ChatGPT	0.959	***	0.962	***	0.951	***	0.938	***	—				
Bard	0.974	***	0.959	***	0.957	***	0.938	***	0.940	***	—		
Grammarly	0.980	***	0.965	***	0.948	***	0.934	***	0.949	***	0.976	***	—
Note. * p < .05, ** p < .01, *** p < .001													

Table 2 presents the correlation between student engagement and Exposure to Language Model Generative AI of the students in Noveleta Senior High School. Using Spearman's Correlation Coefficient, the correlation between exposure to Language Model Generative AI and Students' Engagement was very strong and significantly positive, according to the researchers' findings.

The variables' sub-factors have a very strong positive relationship, which means the exposure and efficacy of Language Model Generative AI tools decreases, the students' engagement also decreases. The students use Language Model Generative AI. Hence, their exposure and engagement are at mid-level. This proves that students did not rely on Language Model Generative AI to overcome their research problems. Language Model Generative AI's inefficacy decreases student engagement. The results somewhat agree with the study of Al-Shammari & Al-Qahtani (2023) which indicates that the utilization of AI tools can greatly influence student motivation and involvement. The research suggests that students are more motivated and engaged in their learning when these tools are efficiently employed.

Conclusion

The researchers found that the level of student engagement in terms of Behavioral, Emotional, Cognitive, and Social is moderate, which means they barely engage with Language Model Generative AI in their research. The students' exposure to Language Model Generative AI, specifically ChatGPT, Bard, and Grammarly, is moderate, which means that they are not that exposed to Language Model Generative AI. After concluding a correlational study and assessment of students' engagement and exposure to Language Model Generative AI, the results were analyzed and found a very strong positive relationship. Despite having a very strong positive relationship, the researchers analyzed that student perceived Language Model Generative AI as ineffective, resulting in a mid-level engagement. The more students perceive it to be ineffective, the more they engage infrequently. To sum up, assisting students in their research is one of the capabilities of Language Model Generative AI. To achieve success in research, it is important to properly understand AI and apply it ethically.

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