

# The Rise of AI in Education: Exploring the Impact of Perception of Large Language Models in the Critical Thinking and Self-efficacy of Health-Allied Senior High School Students

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**Abstract:** Large language models (LLMs), like ChatGPT, have demonstrated the potential to improve student's educational outcomes. This study investigated the impact of health-allied senior high school students' perception of large language models (LLMs) on their critical thinking and self-efficacy. Self-efficacy is a key factor in influencing technology acceptance, suggesting both could play roles in the effective adoption of AI tools. This study used a convergent parallel mixed-methods design to investigate using questionnaires and open-ended questions triangulated to conclude the impact of perceived usefulness and ease of use of LLMs on students' critical thinking and self-efficacy. The 271 participants concluded that they perceived LLMs as easy to use as they make their tasks easier and useful as it helps them understand difficult topics. Their perception influences their critical thinking and self-efficacy; the more they perceive that LLMs are easy to use and useful, the more their critical thinking and self-efficacy domains improve as students perceive benefits in learning and efficiency but also challenges regarding reliability and over-reliance. Ongoing research about LLMs should explore the long-term impact, perception, and broader benefits within the educational landscape.

**Key Words:** artificial intelligence; large language models; chat gpt; technology acceptance

## 1. INTRODUCTION

The rapid advancement of artificial intelligence (AI) is reshaping various aspects of our lives, including education. AI-driven educational tools have the potential to revolutionize teaching and learning by offering personalized guidance, adapting to individual needs, and providing real-time feedback (Xu et al., 2021). Research shows large language models (LLMs) like ChatGPT can improve learning. A study by Lund and Wang (2023) found students using ChatGPT learned a new subject better than those who didn't. Muthmainnah et al. (2022) investigated the impact of AI friend apps on critical thinking skills development in English foreign language learners (EFoLLe) and that AI offers benefits for

learning.

Shanto et al. (2024) created a framework, "AI-CRITIQUE," to help students develop critical thinking skills alongside the AI tool ChatGPT. Students who used the framework along with ChatGPT showed improvement in critical thinking compared to working alone. The study suggests LLMs can be a valuable tool for boosting critical thinking, creativity, and cognitive development. Moreover, students perceived it as beneficial for idea generation and critical analysis.

A study by Singh et al. (2022) explored how self-efficacy influences technology acceptance, finding a strong positive correlation between the two in their survey of 200 participants across Indian industries. The researchers found that people with higher self-efficacy were more likely to accept new technologies. Their

findings support the idea that self-efficacy can be a good predictor of technology adoption.

This study explored how the perception of LLMs can affect health-allied senior high school students' critical thinking and self-efficacy, particularly, addressing the following questions:

1. How do health-allied senior high school students perceive the use of LLMs in terms of
  - a. Perceived Usefulness
  - b. Perceived Ease of Use
2. How does the health-allied senior high school students' perception of LLMs in terms of perceived usefulness and perceived ease of use affect the following:
  - a. Critical Thinking
  - b. Self-Efficacy
3. What are the perceived benefits and challenges of using LLMs, and how do these factors impact the health-allied senior high school student's critical thinking and self-efficacy?

The findings of this study can inform students, teachers, and future researchers about how perception of LLMs could affect student's critical thinking and self-efficacy.

## 2. METHODOLOGY

### 2.1 Research Design

The study adopted a convergent parallel mixed-method design. Convergent parallel mixed-methods design is a research design that combines quantitative and qualitative data collection and analysis to provide a more comprehensive understanding of a research problem. Quantitative and qualitative data are collected simultaneously and analyzed separately in a convergent parallel mixed-methods study. After both analyses are completed, the results are compared and integrated to conclude (Creswell & Clark, 2011).

The study utilized quantitative and qualitative data to examine student perceptions of LLMs and their impact on critical thinking and self-efficacy. Quantitative data, collected through a validated survey, were subjected to statistical analyses. Qualitative data, gathered through open-ended questions, provided deeper insights into student experiences.

### 2.2 Sample and Context

The study gathered data and information at De La Salle Medical and Health Sciences Institute through students under the program of Special Health Sciences Senior High School. The study instilled a purposive criterion sampling technique as the participants must reach specific criteria where they are (a) a health-allied senior high school student, (b) use LLMs such as ChatGPT, Google Gemini (formerly Google Bard), Bing Chat, or other, and (c) use these LLMs at least once a week or more.

A total of 271 students were the respondents of the study. Nearly half (48%) were in grade 11 and the other half (52%) were in grade 12. The majority (75%) were male and the rest (25%) were female. Over half (50%) reported using LLMs at least once a week, with most (83%) using ChatGPT. Only a small portion (3%) used Google Gemini (formerly Google Bard), Bing Chat (5%), or other LLMs (9%). Out of the 271 students who qualified for the quantitative data, 10 were randomly chosen to answer the 4 open-ended questions for qualitative data collection.

### 2.3 Research Instrument, Validation, and Reliability.

The study used the Large Language Models Perception and Impact Questionnaire (LLMPIQ), which the researchers created to collect quantitative data. The questionnaire created is from adapted and modified questionnaires from studies by Buabeng-Andoh (2018), Fatma Yilmaz and Ramazam Yilmaz (2023), and Sachitra (2017). The questionnaire has four main sections: (1) respondents' demographics, (2) Items that measure students' perceived usefulness and perceived ease of use while using LLMs (3) Items that construct critical thinking, and (4) Items that construct self-efficacy with 28 items, excluding questions from the demographic section. The questionnaire used a Likert scale to measure students' perception of LLMs. Additionally, four open-ended questions (not shown) delve deeper into students' experiences by allowing them to express their thoughts and feelings about LLMs in their own words. This combined approach provides a well-rounded understanding of how LLMs interact with and affect students.

The researchers conducted a pilot test to validate the Large Language Models Perception and Impact Questionnaire (LLMPIQ). The instrument measures four constructs: perceived usefulness, perceived ease of use, critical thinking, and self-efficacy. Cronbach's Alpha values for all subscales exceeded 0.70, indicating strong internal consistency. A statistician also reviewed the LLMPIQ to ensure content validity. Weakly aligned items were eliminated, refining the instrument's overall validity and reliability.

## 2.4 Data Analysis

Inductive thematic analysis was used to identify and group recurring themes among the statements given by 10 students who shared their experiences. This allowed us to understand students' experiences with LLMs. Additionally, a statistician analyzed quantitative data (means, standard deviations) to summarize the numerical findings. Through leveraging statistical analysis, researchers were able to extract meaningful information from quantitative data to conclude. Combining these methods, the researchers gained a well-rounded picture of LLM's impact on critical thinking and self-efficacy.

## 3. RESULTS AND DISCUSSION

### 3.1 Perceived Usefulness and Perceived Ease of Use of LLMs

Health-allied senior high school students have perceived LLMs to be useful for their academic purposes. (Table 3.1) shows the overall mean of perceived usefulness of LLMs to be 3.78 which was interpreted as useful. This determined that health-allied senior high school students perceived LLMs as a useful tool to use for their academic work. LLMs can assist the students in understanding difficult topics and provide customized feedback, guidance, and explanation, and develop innovative concepts and ideas (Kalla et. al., 2023).

LLMs have been perceived by the students to be easy to use and have helped them finish tasks efficiently. (Table 3.1) shows the overall mean of perceived ease of use of LLMs as 3.73 which is interpreted to be easy to use. This determined that the health-allied students perceived the use of LLMs to be easy to use in helping them with their academic work. Students can inquire about LLMs which can give fast

feedback and generate meaningful and useful text that can make tasks easier (Meyer et. al., 2023).

Table 3.1. Level of Perceived Usefulness and Ease of Use

Perception	Overall Mean
Perceived Usefulness	3.78
Perceived Ease of Use	3.73

$N = 271$ . Interpretation for perceived usefulness and ease of use: 1.00 – 1.80 (Strongly Disagree), 1.81 – 2.60 (Disagree), 2.61 – 3.40 (Neutral), 3.41 – 4.20 (Agree), 4.21 – 5.00 (Strongly Agree)

### 3.2 Impact of Perception of LLMs on Critical Thinking and Self-efficacy.

#### 3.2.1 Critical Thinking

Table 3.2 shows that upon the use of LLMs for academic purposes, the overall mean (3.76) suggests that students agree that LLMs have increased their critical thinking.

Table 3.3 indicates that both perceptions have a P-value of 0.000. This shows that the perceived usefulness and ease of use have a positive correlation with critical thinking. Students who perceived LLMs to be useful and easy to use will likely score a higher level in critical thinking (Davis, 1989; Davis, 1993, as cited in Marikyan & Papagiannidis, 2023).

Table 3.4 indicates that the effect size of perceived usefulness on critical thinking is 33.99%, while the effect size of ease of use on critical thinking is 35.28%. R-value shows that perceived usefulness (.583) and perceived ease of use (.594) indicate that the independent variables have a moderate positive correlation with critical thinking.

Table 3.2 Level of Critical Thinking

Perception	Overall Mean
Critical Thinking	3.76

$N = 271$ . Interpretation for level of critical thinking: 1.00 – 1.80 (Strongly Disagree), 1.81 – 2.60 (Disagree), 2.61 – 3.40 (Neutral), 3.41 – 4.20 (Agree), 4.21 – 5.00 (Strongly Agree)

Table 3.3 Regression Analysis of Perceptions of LLMs on Critical Thinking

Term	Coef	<i>p</i>
Constant	1.405	0.000
Perceived Usefulness	.2878	0.000
Perceived Ease of Use	.3416	0.000

Predictors: (Constant), Critical Thinking

Table 3.4 Pearson's Correlation and Effect Size of Perceived Usefulness and Ease of Use on Critical Thinking

Independent Variable	Dependent Variable	<i>r</i>	<i>r</i> <sup>2</sup>	<i>p</i>
Perceived Ease of Use	Critical Thinking	.594	35.28%	0.000
Perceived Usefulness		.583	33.99%	0.000

\*Significant at .05 level

### 3.2.2 Self-efficacy

Table 3.5 indicates the overall mean (3.60) of the level of self-efficacy. This shows that students agree that LLMs have helped them in their academic purposes and helped them finish their academic work.

Table 3.6 shows the p-value of perceived usefulness and ease of use are both 0.000. These findings indicate that perceived usefulness and ease of use have a positive correlation with self-efficacy. Students who perceived LLMs to be useful and easy to use will score higher on self-efficacy (Davis, 1989; Davis, 1993, as cited in Marikyan & Papagiannidis, 2023).

Table 3.7 indicates that the effect size of perceived usefulness on self-efficacy is 36.36%, while the effect size of perceived ease of use on self-efficacy is 39.19%. The r-value of perceived usefulness (.603) and ease of use (.626) indicates that there is a moderate positive correlation towards self-efficacy.

Table 3.5 Level of Self-efficacy

Perception	Overall Mean
Self-efficacy	3.60

*N* = 271. Interpretation for level of self-efficacy: 1.00 – 1.80 (Strongly Disagree), 1.81 – 2.60 (Disagree), 2.61 – 3.40 (Neutral), 3.41 – 4.20 (Agree), 4.21 – 5.00 (Strongly Agree)

Table 3.6 Regression Analysis of Perceptions of LLMs on Self-efficacy

Term	Coef	<i>p</i>
Constant	1.034	0.000
Perceived Usefulness	.2853	0.000
Perceived Ease of Use	.3989	0.000

Predictors: (Constant), Self-efficacy

Table 3.7 Pearson's Correlation and Effect Size of Perceived Usefulness and Ease of Use on Self-efficacy

Independent Variable	Dependent Variable	<i>r</i>	<i>r</i> <sup>2</sup>	<i>p</i>
Perceived Ease of Use	Self-efficacy	.626	39.19%	0.000
Perceived Usefulness		.603	36.36%	0.000

\*Significant at .05 level

## 3.3 Perceived Benefits and Challenges and its Impact on Critical Thinking and Self-efficacy

### 3.3.1 Perceived Benefits of LLMs

Health-allied senior high school students have perceived LLMs to benefit them in academic purposes. Two most frequent themes emerge the most amongst participants' narratives: Learning & Understanding and Information Access, Time Management and Efficiency.

LLMs have assisted the students in understanding concepts or improving their critical thinking. In a study by Essel et. al. (2023), the use of LLMs has effectively improved the critical thinking of students in their in-class activity based on their study results.

*Student 4: "...its ability to explain in simpler terms the difficult concepts."*

The sample narrative above expresses the participant's perception that LLMs have helped them by giving simpler terms to understand difficult concepts.

Students also viewed LLMs to help finish their tasks efficiently as well as save time in doing so, which then improved their self-efficacy (Urban et. al., 2024).

*Student 7: "Chat GPT helps students maximize their time, especially to meet the deadline."*

The sample narrative above indicates the student's perception on LLMs that it can aid them in maximizing their time to submit activities on time.



### 3.3.2 Impacts of Perceived Benefits on Critical Thinking and Self-efficacy

Study participants indicated how their perceived benefits can impact critical thinking and self-efficacy. Two most frequent themes emerge the most in the participants' narratives: Support, Enhancement, and Understanding, Efficiency.

Students indicated that using LLMs has helped them further understand and learn concepts better, increasing their critical thinking. LLMs provide simple and comprehensive explanations for the students which helps them understand concepts (Bernabei et. al., 2023).

*Student 1: "It allows them to have a literal study assistant that may provide direct explanations for certain topics or questions."*

The sample narrative above shows the student's perception that LLMs can be a study assistant that can provide direct explanations for topics or questions of the user.

LLMs also enhance students' self-efficacy by assisting them in doing their tasks efficiently while still providing quality work (Murusugan et. al., 2023).

*Student 3: "These help the students do their tasks in a short period of time but with good quality of work."*

The sample narrative above expresses the student's perception that LLMs can help them work on their tasks quickly while maintaining good work quality.

### 3.3.3 Perceived Challenges of LLMs

Health-allied students have perceived challenges in the use of LLMs for academic purposes. The two most frequent themes have been found amongst the responses: Accuracy and Reliability Concerns, Dependency and Over-reliance.

ChatGPT only has information limited until 2021, which can have concerning reliability (Sallam, 2023). Students have shown concerns about the accuracy and reliability of LLMs which can generate inaccurate information and present it as facts.

*Student 6: "Sometimes the information can be a bit false. For example, if you restate the question to chat GPT, it interprets it as 'wrong answer' and gives you a different one."*

Student 6 has perceived that LLMs can provide misinformation. In their experience of using ChatGPT, its initial response will be regarded as the wrong answer and generate a new one, hence why the participant thinks that LLMs can generate inaccurate information.

Students also perceived that users may become overly reliant on LLMs. Being overly reliant on these

technologies may have a possible effect on an individual to turn into a "lazy thinker" (Farrow, 2022).

*Student 10: "Over-reliance to these types of LLMs are the challenge a health allied students can experience... we no longer double-checked or fact-checked what these LLMs is giving to us we just copy and paste it."*

Student 10 has perceived that one of the challenges of LLMs is that it can make an individual to be overly-reliant and will only copy and paste the generated answers by these technologies.

### 3.3.4 Impacts of Perceived Challenges on Critical Thinking and Self-efficacy

Students have indicated the impacts of their perceived challenges on critical thinking and self-efficacy. One theme only emerges from the responses: Over-Reliance.

LLMs have also been associated with losing human decision-making and laziness (Ahmad et al., 2023). Additionally, the use of LLMs can promote procrastination and make students lazy and less productive (Mogavi et al., 2024). LLMs can execute tasks given by the user and do all of the work which leads to laziness, and lack of human decision-making, thus hindering the development of critical thinking and self-efficacy.

*Student 9: "These challenges potentially hinder their critical thinking and self-efficacy by making them reliant on these LLMs..."*

The sample narrative from student 9 expresses their perception on the impact of perceived challenges on critical thinking and self-efficacy. The narrative indicates that by being overly-reliant on LLMs can hinder the development of critical thinking and self-efficacy.

*Student 7: "Students might get laid-back and reduce their critical thinking skills because of how AI gives the answers in just one click and does not require the students a chance to use their brains."*

In addition, student 7 expresses their perception that a student can be laid-back due to how LLMs can give an answer in just a click. Without using their brain, it might also reduce someone's critical thinking and self-efficacy as well.

### 3.4 Converging of Quantitative and Qualitative Findings

The findings of this study have found that the results and data from the qualitative aspect of this study

support quantitative findings. In the quantitative findings, it has been found that the use of LLMs can increase critical thinking. In the qualitative discussion, the impacts of perceived benefits suggest that most of the students perceived that the use of LLMs can increase critical thinking or learn concepts better since the theme, Support, Enhancement, and Understanding were found in most of the responses from the students.

Furthermore, findings in the quantitative aspect of the study have found that the use of LLMs can increase self-efficacy. In the qualitative discussion, the impacts of perceived benefits suggest that students perceived LLMs to increase their self-efficacy or help them do their tasks efficiently since the theme, Efficiency was found frequently among the responses.

#### 4. CONCLUSIONS

This study investigated how health-allied senior high school students perceive LLMs and how these perceptions affect their critical thinking and self-efficacy. Students perceived LLMs as useful and easy to use. The study found that students who perceived LLMs as more useful and easier to use also showed greater critical thinking and self-efficacy.

Students reported that LLMs helped them learn and complete tasks more efficiently. However, they also worried about LLM reliability and becoming overly reliant on the technology. These concerns aligned with the finding that students who perceived LLMs as less reliable or worried about dependence showed lower critical thinking and self-efficacy.

Longitudinal studies can be conducted to investigate the long-term impact of LLM use on critical thinking and self-efficacy. These studies could examine learners from different fields, not just health-allied students.

Overall, the study findings provided informative results that showed that students' perception of LLMs impacts their critical thinking and self-efficacy.

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