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Human vs. AI: Comparing Student-Written and ChatGPT-Generated Essays in Terms of Thematic Progression and Rhetorical Organization

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Abstract

This qualitative study compares 27 argumentative essays written by Grade 12 students at Pualas National High School in the Philippines with a ChatGPT-generated essay in response to the same prompt. Drawing on thematic progression and genre-based analysis, it examines textual organization, Theme–Rheme development, engagement and stance, contextualization, and the development of arguments and counterarguments. The analysis identifies both shared conventions and differences across the texts. Both student and AI-generated writing generally follow a recognizable argumentative structure and develop related themes concerning the potential effects of artificial intelligence on future employment. The student essays, however, display greater variation in paragraph development, more frequent personal positioning, and examples grounded in familiar contexts. The ChatGPT-generated essay presents a more consistently organized and generalized discussion, with explicit transitions and a comparatively impersonal tone. These observations describe the texts in this corpus and should not be interpreted as evidence of differences in students' cognitive abilities or as defining characteristics of AI-generated writing more broadly. The study contributes a context-specific qualitative comparison of thematic and rhetorical features in secondary-level writing and highlights the value of assessing argument development and contextual relevance alongside linguistic accuracy. The findings support the use of AI-generated texts as materials for critical evaluation, provided that students remain responsible for developing and defending their own arguments.

1. Introduction

The integration of artificial intelligence (AI) tools such as ChatGPT into educational contexts has raised concerns about the authorship and originality of student writing. While AI-assisted writing technologies provide support and efficiency, they also challenge traditional conceptions of writing. Writing, particularly in second-language contexts, is a complex activity involving grammar, diction, coherence, and cohesion. Flower and Hayes (1981) observed that student writing often displays grammatical inconsistencies, uneven coherence, and an emerging authorial voice, which are considered indicators of authentic learning rather than deficiencies. In contrast, AI-generated texts are typically marked by grammatical accuracy, fluency, and structural uniformity. According to Georgiou (2025), AI texts often use consistent discourse markers and uniform sentence structures, producing linguistic features distinguishable from human-written essays. Although AI tools generate texts with high lexical and grammatical complexity, these texts often lack genuine communicative effect.

Recent studies indicate that AI-generated texts exhibit recognizable linguistic patterns that distinguish them from human-written texts. Herbold et al. (2023) found that AI texts often rely on formulaic transitions, such as "in addition," "moreover," and "furthermore," and follow predictable structures. While these patterns contribute to coherence, they also result in structural monotony. Similarly, Kasneci et al. (2023) observed that AI-generated academic texts frequently display complex syntactic patterns and advanced lexical use but lack substantive argumentative claims. This sophistication may lead to contextually inappropriate or vague vocabulary.

In contrast, students often rely on familiar lexical items, sometimes repetitively, and their word choices typically reflect personal understanding. These lexical choices, even when imperfect, provide insight into the learner's cognition. Contextual grounding further distinguishes student writing from AI-generated output. Student essays are shaped by the writers' backgrounds, with senior high school students' writing often reflecting local realities and educational challenges specific to their environment. AI-generated texts, by drawing on generalized data, tend to produce neutral responses. This lack of specificity can render AI-generated texts less responsive. Given these concerns, it is necessary to examine how AI-generated writing compares with authentic student writing. Understanding the situational and linguistic differences between the two can inform instructional practices and academic ethical policies. Rather than viewing AI solely as a threat, this study enables educators to identify both the strengths and limitations of AI-generated writing.

Research on generative AI and writing has examined writing quality, linguistic features, topic development, engagement, lexical bundles, metadiscourse, and students' experiences of AI-assisted composition (Herbold et al., 2023; Jiang & Hyland, 2025a, 2025b, 2025c; Levine et al., 2025; Yang et al., 2024). These studies offer useful accounts of how AI-generated texts compare with student writing, but much of the comparative evidence comes from university-level or other educational contexts, larger corpora, or specific linguistic features examined separately. Less is known about how thematic progression and broader rhetorical organization appear together in a small, naturally occurring corpus of secondary-school argumentative essays, particularly in a Philippine classroom context.

The present study addresses this context-specific gap by examining 27 Grade 12 EAPP essays alongside one ChatGPT-generated essay responding to the same prompt. Yang et al. (2024) provide a direct point of comparison through their analysis of thematic choices and progression in human- and AI-generated texts. The present study extends this line of inquiry in a different educational setting by interpreting thematic development alongside engagement and stance, argumentative moves, counterargument handling, and contextualization. Its purpose is not to establish universal differences between human and AI writing, but to describe how these features are realized in the particular texts examined.

The study also treats thematic and rhetorical similarities cautiously. When writers respond to the same prompt and work within the same school genre, similarities may arise from shared task requirements and conventional expectations for argumentative essays; they do not, by themselves, demonstrate textual dependence or AI use. In addition, coherence, engagement, contextual specificity, and argument quality are related but distinct dimensions. Examining them together makes it possible to distinguish the organization of a text from the extent to which its claims are elaborated and situated.

This comparison also serves a pedagogical purpose. Teachers need assessment practices that attend not only to surface features such as grammatical accuracy and paragraph structure but also to the development of claims, supporting reasons, evidence, counterarguments, and contextual relevance. The present study therefore uses discourse-oriented analysis to identify textual patterns that can inform the teaching and assessment of argumentative writing in AI-enabled learning environments.

The study addresses these concerns through a qualitative comparative analysis of 27 Grade 12 EAPP student essays from Pualas National High School and one ChatGPT-generated essay

produced in response to the same argumentative prompt. The analysis focuses on textual organization and thematic progression, engagement and stance, argumentative development, and contextualization. The student essays constitute the primary corpus; the single AI-generated essay serves as a bounded comparison text rather than a representative sample of AI writing.

Rather than establishing a fixed distinction between human and AI writing, this study investigates how the analyzed texts realize conventions of argumentative discourse within a specific educational context. Its contribution lies in bringing thematic development into conversation with rhetorical and pedagogical considerations in secondary English education. Because the corpus is small and includes only one AI-generated text, the findings are exploratory and should be interpreted as observations about this corpus.

The study compares the linguistic and rhetorical features of student-written essays and the ChatGPT-generated response. It is guided by the following research questions:

The analysis specifically sought to answer the following questions:

1. How are themes and arguments developed through textual organization and thematic progression in the student essays and the ChatGPT-generated essay?
2. What similarities and differences are observable in engagement and stance, argumentative development, counterargument handling, and contextualization across the student essays and the ChatGPT-generated essay?

2. Literature Review

2.1 Writing as a Cognitive, Linguistic, and Rhetorical Process

Writing is a multidimensional activity involving cognitive, linguistic, and rhetorical resources. It requires writers to generate ideas, organize information, establish relationships among propositions, and communicate meaning according to an intended purpose and audience. Flower and Hayes (1981) conceptualize writing as a recursive process involving planning, translating, and reviewing. Rather than occurring in a fixed sequence, these processes interact throughout composition as writers develop ideas, construct arguments, and evaluate their emerging texts.

These processes are particularly relevant to argumentative writing, which requires writers to establish a position, substantiate claims, consider alternative perspectives, and formulate defensible conclusions. Consequently, writing quality cannot be assessed solely through grammatical accuracy, vocabulary, or structural conformity. McNamara et al. (2010) emphasize the multidimensional nature of writing quality, highlighting the importance of examining lexical, syntactic, and discourse features in relation to the communicative purpose.

This perspective is particularly important in comparisons between student-produced and AI-generated texts. Although generative AI can produce grammatically accurate, conventionally structured essays, these features do not necessarily reflect the quality of their reasoning, contextual relevance, or argumentative development. Similarly, linguistic inaccuracies in student writing do not automatically indicate weaknesses in reasoning. Thus, comparative analysis requires attention to how writers organize information, develop arguments, establish rhetorical relationships, and communicate their positions.

2.2 Thematic Progression and the Organization of Written Discourse

Thematic progression offers a linguistic framework for examining how information is organized and developed across a text. Within Systemic Functional Linguistics (SFL), the Theme–Rheme structure describes the organization of meaning within a clause. The Theme serves as the point of departure of the message, while the Rheme develops the information introduced by the Theme.

Daneš (1974) established the importance of examining thematic relationships across successive clauses, identifying patterns through which information is maintained and

developed. These include constant progression, in which a recurring Theme sustains a topic; linear progression, in which information introduced in one Rheme becomes the Theme of a subsequent clause; and derived progression, in which multiple Themes develop from a broader overarching topic.

In argumentative writing, these patterns help reveal how writers sustain central concerns, introduce supporting propositions, and develop relationships among claims, reasons, and implications. However, thematic progression should not be equated with the presence of cohesive devices. Conjunctive expressions such as *however*, *furthermore*, and *therefore* contribute to textual cohesion, but their occurrence does not necessarily demonstrate meaningful thematic development. Analysis must instead consider how successive clauses introduce, maintain, or extend information.

This distinction is particularly relevant to comparisons of student and AI-generated essays because texts may exhibit conventional transitions while differing in the depth and direction of their argumentative development. Accordingly, thematic progression provides a basis for examining both topic continuity and the development of related propositions across clauses and paragraphs.

2.3 Empirical Comparisons of Human-Written and AI-Generated Texts

Empirical comparisons of human-written and AI-generated texts have demonstrated that similarities and differences depend on the linguistic and rhetorical features being examined, as well as the genre, writing task, and corpus involved. Herbold et al. (2023), for instance, found that ChatGPT-generated essays could receive high-quality ratings while retaining distinguishable linguistic characteristics. Their findings suggest that conventional essay structure and perceived writing quality do not fully capture the differences between human and machine-generated texts.

Research examining thematic organization provides further evidence of these distinctions. Yang et al. (2024) compared human-written and AI-generated argumentative texts using systemic functional grammar and identified differences in the selection and development of textual, interpersonal, and marked topical Themes. AI-generated texts employed additive conjunctive adjuncts more frequently and demonstrated distinct patterns in expressing concession and conditional relationships. These findings indicate that differences in argumentative writing may become more apparent through clause-level thematic analysis than through the examination of overall essay structure alone.

Differences have also been reported in rhetorical engagement and authorial positioning. Jiang and Hyland (2025b), examining 145 student essays and 145 ChatGPT-generated essays, found that student writers employed a greater number and wider range of engagement markers; questions and personal asides were particularly limited in the AI-generated texts. Jiang and Hyland (2025a) identified differences in lexical bundles and their functions, with student writing demonstrating greater use of epistemic stance and authorial presence, while AI-generated texts relied more heavily on certain abstract and organizational expressions. Their analysis of metadiscourse further showed that ChatGPT-generated essays tended to favor structural guidance while student essays displayed stronger interactional resources (Jiang & Hyland, 2025c).

These studies suggest that comparisons between human- and AI-generated argumentative writing should extend beyond grammatical accuracy and overall structure. Thematic development, reader engagement, lexical choices, and metadiscourse provide complementary perspectives on how arguments are organized and communicated. However, the reported patterns are not a universal profile of AI writing: they may vary with the model, prompt, genre, educational level, and human comparison corpus. These qualifications inform the present study's focus on observable textual features rather than assumptions about authorship or cognition.

2.4 AI-Assisted Writing, Student Learning, and Authorial Voice

Research on AI-assisted writing further complicates the distinction between human- and machine-generated texts. Students may interact with generative AI at different stages of composition, including idea generation, planning, drafting, and editing. Levine et al. (2025), investigating high school students' use of ChatGPT in argumentative writing, demonstrated that students engaged with AI-generated versions of their texts and compared them with their own writing. These interactions provided opportunities to reflect on rhetorical choices and the development of authorial voice.

Similarly, Wang (2025) examined the use of generative AI in university students' writing and identified tensions between utilizing AI to improve writing and maintaining individual authorial voice. This suggests that AI literacy involves more than the ability to generate fluent text or formulate effective prompts; it also entails making informed decisions about the use of AI-generated suggestions while retaining control over one's writing.

These studies establish the importance of distinguishing among AI-generated texts, AI-assisted writing processes, and student-produced texts. The three represent different research objects and require different forms of evidence. In particular, observable textual features cannot independently establish whether a student used AI, how much assistance was received, or how the final text was composed.

The present study therefore focuses on the final student essays and the ChatGPT-generated comparison text. It examines similarities and differences in their linguistic organization, argumentative development, and rhetorical positioning without attempting to determine students' AI use or reconstruct their composing processes.

2.5 Synthesis and Implications for the Analytical Framework

The reviewed literature indicates that writing quality and distinctions between student- and AI-generated argumentative texts cannot be adequately understood through surface-level linguistic features or overall structural conformity alone. Flower and Hayes's (1981) cognitive process theory and McNamara et al.'s (2010) multidimensional perspective support examining textual features in relation to communicative purpose, while Daneš's (1974) account of thematic progression provides a framework for tracing how information is maintained and developed across clauses. Empirical comparisons by Herbold et al. (2023), Yang et al. (2024), and Jiang and Hyland (2025a, 2025b, 2025c) demonstrate the value of examining thematic organization, engagement, lexical bundles, and metadiscourse.

On this basis, the study uses four connected analytical dimensions: (1) textual organization and thematic progression, examining Theme–Rheme relationships and information development; (2) engagement and stance, examining how writers express positions and orient readers; (3) argumentative development, examining claims, supporting reasons, counterarguments, and resolutions; and (4) contextualization and textual evidence, examining the relevance of examples, the support provided for claims, and the implications developed. These dimensions are used as interpretive categories, not as independent measures of authorship, cognitive ability, or overall writing quality.

The framework operates at two interconnected levels. At the textual level, the analysis examines how linguistic resources organize information within and across clauses and paragraphs. At the rhetorical level, it considers how the essays construct arguments, position claims, engage readers, and establish contextual relevance. This combined framework allows the study to describe both shared genre conventions and differences in how the texts elaborate their arguments.

3. Methodology

3.1 Research Design

The study employs a qualitative comparative design informed by genre analysis and systemic functional accounts of thematic progression. Close reading was used to examine how

the essays organize information, develop arguments, and position writers in relation to readers. The analysis is descriptive and interpretive; it does not test statistical differences or make population-level claims. The 27 student essays are considered collectively, while the single ChatGPT-generated essay is treated as one comparison text.

3.2 Corpus of the Study

The corpus comprises 27 argumentative essay assignments submitted by Grade 12 students enrolled in English for Academic and Professional Purposes (EAPP) at Pualas National High School during the 2025–2026 academic year. One additional argumentative essay was generated using ChatGPT (GPT-4o, accessed January 2026) in response to the same prompt given to the students. Thus, the corpus contains 28 texts in total: 27 student-authored essays and one AI-generated comparison essay. The AI essay is not treated as a matched sample for each student essay, nor as representative of ChatGPT output generally. All student essays were anonymized before analysis.

3.3 Data Collection

The student essays were drawn from existing EAPP course submissions and obtained with permission from the educational institution and in accordance with applicable ethical requirements. No new essays were solicited for the study. The ChatGPT comparison essay was generated by submitting the same argumentative prompt used for the student assignment. The model and access date are reported to make the generation context transparent; however, the single output cannot capture the variability of responses that may be produced under other prompts, model versions, or settings. The texts were compiled in digital format for qualitative comparison. The manuscript does not claim that the student essays were produced without AI assistance, because students' composing processes and possible use of AI were not investigated.

3.4 Data Analysis Procedure

The analysis proceeded through iterative close reading and comparison. The researchers examined the 27 student essays as a group and then considered the single ChatGPT-generated essay as a comparison text. The procedure involved three stages:

1. Familiarization and initial coding. The researchers read the student essays and the ChatGPT-generated essay repeatedly, recording observations about textual organization, Theme–Rheme development, lexical and cohesive choices, engagement and stance, contextual references, claims, supporting reasons, and counterarguments. Coding focused on features present in the texts rather than inferred author intentions or cognitive processes.
2. Comparative examination of patterns. The researchers compared recurring features across the student corpus and identified points of convergence and divergence between the student essays and the single AI-generated text. Because the AI comparison consisted of one essay, comparisons were made at the level of observed textual patterns; no one-to-one or statistical matching between individual student essays and AI output was conducted.
3. Interpretive synthesis. The researchers synthesized the coded observations and selected illustrative excerpts to explain how the texts organized and developed their arguments. Interpretations were checked against the wording and context of the essays. The analysis did not assign numerical scores or claim statistically significant differences. It also did not use textual features as direct evidence of students' cognitive processes, originality as a psychological trait, or whether AI was used in composing any student essay.

4. Results and Discussion

4.1 Linguistic and Rhetorical Similarities and Differences in Student and ChatGPT-Generated Essays

The qualitative comparison of the 27 Grade 12 student essays and one ChatGPT-generated essay identified shared conventions as well as differences in textual organization, thematic development, lexical choices, coherence, engagement, and rhetorical positioning. The patterns reported below describe the texts in this corpus. Since the AI comparison consists of a single essay, the analysis does not support generalizations about ChatGPT output as a whole.

4.1.1 Structural Organization

Student-written essays typically adhere to a basic structure comprising an introduction, body, and conclusion. Most begin with a direct response to the prompt, followed by an explanation and a concluding statement. Some responses open with the phrase "*I believe*," signaling a direct answer, while others introduce artificial intelligence in a single sentence before addressing the question.

- *"I believe that artificial intelligence will both improve and threaten future job opportunities at the same time."*
- *"AI can help make work easier by doing tasks…"*
- *"If people continue learning and improving their skills, they will be more ready for a future where AI is part of many jobs."*
- *"Artificial intelligence has the potential to both improve and threaten future job opportunities."*

Across the student corpus, essays commonly restate or directly answer the prompt before providing explanations and a concluding statement. This pattern is consistent with the instructional expectations of an argumentative essay assignment. The examples above illustrate how students state a position or introduce the relationship between AI and future employment in relatively direct language.

The ChatGPT-generated essay also follows a recognizable argumentative structure, with an introduction, development of supporting points, acknowledgment of potential disadvantages, and a conclusion. Its paragraphs are more consistently organized around discrete points and connected through explicit transitions. This produces a comparatively regular surface structure in the one AI-generated text examined. The contrast should not be read as evidence that all AI texts are formulaic or that all student texts are structurally variable.

Student essays show more variation in paragraph length and in the number of ideas developed within a paragraph. In some cases, shifts between ideas make the line of argument less explicit for readers. Such variation is best described as a feature of the submitted texts, rather than assumed to reveal the students' cognitive processes. The examples indicate that student writers sometimes express a position and move quickly between related points without fully signaling the relationship between them.

> *"Artificial intelligence will both improve and threaten future job opportunities, with the outcome depending on how we adapt technology and workforce skills. On the positive side, AI will spawn entirely new roles such as AI ethicists, prompt engineers, machine learning maintenance specialists, and data strategy consultants, along with positions in emerging fields like autonomous vehicle testing and AI-driven healthcare diagnostics. By automating repetitive tasks like data entry and basic report generation, it also frees workers to focus on high-value work, including creative problem-solving, strategic planning, and human-centric interactions such as customer relationship building. Additionally, AI drives growth in sectors like renewable energy (optimizing grid efficiency), precision agriculture (crop yield prediction), and telemedicine (remote patient monitoring), creating demand for skilled labor in these areas. However, AI*

poses threats: jobs involving predictable, rule-based tasks—such as basic bookkeeping, assembly line work, customer service chat support, and some data processing roles—are at risk of automation. Workers with outdated skills, like those relying solely on manual data entry or basic software use, may struggle to compete without upskilling, and rapid AI adoption could lead to uneven job losses across regions and industries, particularly in areas with limited access to reskilling programs. Ultimately, proactive adaptation investing in education and vocational training to equip workers with AI-complementary skills like critical thinking, creativity, and emotional intelligence will maximize AI's benefits while mitigating its threats."

In contrast, some student-written essays display less consistent paragraph-level development, with more than one idea sometimes appearing in the same paragraph. This can make relationships between claims and explanations less explicit. These observations concern the organization of the written products; the study did not collect process data that would establish why these patterns occurred.

"AI will make jobs better. This lots teachers spend more time talking to students. AI also creates new job. People who fix AI tools check that they're fair, or teach other how to use them. But AI will also make some jobs harder."

4.1.2 The Use of Engagement Markers

Engagement markers are linguistic resources through which writers position themselves and orient readers. In this study, the analysis considered pronouns, expressions of personal stance, rhetorical questions, and direct reader address. Their presence or absence is described as a textual feature and is not treated as a direct measure of a writer's actual engagement or intention.

First-person expressions such as "I believe" and "I think" occur in some student essays and make the writer's position explicit. Other examples use inclusive pronouns such as "we" or third-person references to people affected by AI. Rhetorical questions and direct reader address are generally uncommon in the student texts. The examples illustrate the range of positioning resources observed in the corpus.

- *"AI is not fully good or bad, it depends on how we adapt or use it."*
- *"Because of this, some people may lose jobs if they do not have enough training or new skills."*

The ChatGPT-generated essay adopts a comparatively impersonal and generalized tone. It refers to people and workers in broad terms and uses inclusive pronouns selectively. In the single AI text examined, rhetorical questions and direct reader address are absent. This pattern is consistent with Jiang and Hyland's (2025b, 2025c) observations that ChatGPT-generated argumentative essays may contain fewer interactional or reader-engagement resources than student writing, although the present corpus is too small to establish a broader pattern.

4.2 Situational and Rhetorical Features of Student and ChatGPT-Generated Essays

4.2.1 Contextualization, Critical Reasoning, and Originality

The comparison identified differences in how the student essays and the ChatGPT-generated essay contextualized their claims and elaborated their positions. These are differences in the textual evidence available for analysis; they should not be interpreted as differences in students' critical-thinking ability or as proof that originality is inherently human.

Some student essays explicitly position the writer through expressions such as "For me" and "I think," and several acknowledge that AI may have both beneficial and harmful effects. Such statements make the writer's stance visible in the text. However, personal positioning alone does not establish the depth of the reasoning behind a claim. The analysis therefore considered whether the essays also supplied reasons, examples, qualifications, or implications to support their positions.

Some student essays refer to familiar settings, including schools, hospitals, and workplaces, and discuss possible consequences for people who may lack access to training or new skills. These references provide contextual detail and can make the arguments more locally intelligible. The presence of an example, however, does not by itself establish that a claim is accurate or fully supported. This distinction is important when interpreting contextualization as a feature of written argument rather than as direct evidence of the writer's cognitive activity.

The ChatGPT-generated essay presents a comparatively extended and orderly account of possible benefits and risks, including job creation, automation, productivity, and the need for reskilling. Much of its discussion is framed in generalized terms rather than through specific local experiences. Its logical sequencing and breadth of examples contribute to textual completeness, but the analysis does not treat these qualities as evidence of machine or human critical thinking. Likewise, the student essays' personal references are treated as textual features rather than proof of an internal cognitive process.

Overall, the student essays more often contain explicit personal positioning and references to familiar contexts, whereas the single ChatGPT-generated essay offers a more generalized and systematically organized discussion. The distinction concerns the form and content of the texts examined. Because the study did not observe planning, drafting, revision, or students' use of AI, it cannot determine the cognitive processes behind the essays or establish that one source is inherently more original or more capable of critical thought.

4.2.2 Argumentative Development and Handling of Counterarguments

The researchers examined how claims, supporting reasons, opposing considerations, and resolutions were presented across the student essays and the ChatGPT-generated essay. The analysis focused on the observable organization and elaboration of arguments, including whether the texts acknowledged counterarguments and how they responded to them.

Across the corpus, a recurring argumentative topic was the dual potential of AI to improve and threaten future job opportunities. Many student essays and the ChatGPT-generated essay addressed benefits, risks, and the importance of adaptation. This convergence may reflect the shared prompt and the conventional expectation that argumentative writing acknowledge multiple sides of an issue; it does not establish that students copied or relied on AI-generated content.

The ChatGPT-generated essay develops a relatively symmetrical sequence. It introduces the possibility of both benefits and risks, discusses automation-related job displacement, presents new employment opportunities and productivity gains, and concludes with the importance of education and adaptation. The sequence is made explicit through paragraph organization and transitions.

The student essays also develop themes concerning job creation, automation, productivity, and adaptation, although the extent and order of elaboration vary. Some emphasize the potential for new careers and improved services, while others focus more on job displacement or the need for workers to acquire new skills. The common topic sequence is therefore a broad pattern rather than an identical structure shared by every essay.

The thematic similarities can be summarized as a recurring sequence across the texts, although not every essay realizes each stage in the same order or with the same degree of elaboration:



Figure 1. ***Thematic Pattern of Student Essays and AI-Generated Text***

The recurrence of subthemes such as emerging jobs, automation of routine tasks, productivity, and the importance of human skills suggests that both the student corpus and the AI comparison text draw on familiar argumentative content associated with the prompt. Because all writers responded to the same topic and genre requirements, thematic convergence may be explained by shared task expectations. The present study cannot determine whether AI influenced students or whether the similarity reflects independent responses to a conventional topic.

These findings have pedagogical relevance, but they do not establish that AI use necessarily weakens learning or that the students' essays were AI-assisted. Wu and Yu's (2024) meta-analysis discusses the potential effects of AI chatbots on learning outcomes, but its findings should not be used to infer learning effects in the present study, which examined completed texts only. A more cautious implication is that teachers should create opportunities for students to explain and defend their arguments and should teach them to evaluate AI-generated content rather than accept it uncritically.

5. Pedagogical Implications

The findings suggest several implications for teaching argumentative writing in AI-supported learning environments. The observed differences between the student essays and the single ChatGPT-generated essay indicate that assessment practices focused only on grammatical accuracy, structural organization, and fluency may overlook other important dimensions of writing. Teachers may also consider thematic development, the relationship between claims and supporting reasons, engagement and stance, counterargument handling, and contextual relevance.

Educators can give students opportunities to explain, elaborate, and defend their written positions. Oral defenses, classroom discussions, reflective writing, and supervised in-class writing can complement take-home assignments by offering additional evidence of students' understanding. These activities allow teachers to ask students to clarify claims, justify reasons, respond to alternative perspectives, and connect arguments to relevant contexts. Such practices assess learning more directly than attempting to infer cognitive ability from textual features alone.

AI integration in writing instruction should be accompanied by explicit expectations concerning responsible use and academic integrity. Teachers may use AI-generated essays as objects of critique: students can identify unsupported claims, generalized examples, weak counterarguments, or effective organizational choices, and then explain how they would revise them. Students should be taught to verify factual claims, evaluate AI-generated suggestions, and make independent decisions about which suggestions to adopt. These practices position AI as a resource for critical evaluation rather than a substitute for students' own argument development.

A comprehensive approach to assessing argumentative writing should therefore consider linguistic proficiency, thematic development, contextual relevance, and rhetorical

effectiveness, while also gathering evidence that students can explain and defend their arguments. The present findings are exploratory and do not justify using any single textual feature to identify AI authorship or to make judgments about a student's thinking.

6. Conclusion

This study compared 27 Grade 12 student-written argumentative essays with one ChatGPT-generated essay, focusing on thematic progression, textual organization, engagement and stance, argumentative development, and contextualization. Both sets of texts followed recognizable argumentative conventions and addressed the shared topic through claims about the potential benefits and risks of AI for future employment. The thematic overlap may be related to the common prompt and genre expectations.

Within this corpus, student essays displayed greater variation in paragraph development, more frequent explicit personal positioning, and references to familiar contexts. The ChatGPT-generated essay was more consistently organized and presented a comparatively generalized discussion with explicit transitions. These observations describe the texts analyzed and should not be generalized to all student writing or AI-generated writing.

The findings do not demonstrate that students possess greater critical-thinking ability or originality than AI systems, nor do they establish that these qualities are inherently human. The study analyzed completed written products and did not directly measure students' planning, reasoning, decision-making, revision practices, or use of AI during composition. Textual features such as personal stance and contextual examples can be discussed as evidence in the essays, but they cannot independently establish the cognitive processes that produced them.

The study nevertheless demonstrates the value of an integrated analysis of thematic organization, rhetorical engagement, argumentative development, and contextual relevance in secondary-level writing. In AI-supported educational settings, assessment can move beyond grammatical correctness and structural conformity by examining how arguments are developed, supported, qualified, and situated. The findings provide a context-specific basis for pedagogical reflection rather than a definitive distinction between human and AI authorship.

7. Recommendations and Limitations

The findings should be interpreted in light of several limitations. First, the corpus comprised 27 student essays and only one ChatGPT-generated comparison essay. The AI text cannot represent the range of outputs that may be produced by different models, prompts, versions, or generation settings. Second, the analysis was qualitative and focused on completed texts; it did not include statistical testing, writing-process data, or direct measures of students' cognitive abilities. Third, the study did not investigate whether students used AI tools when preparing their essays. Accordingly, the results describe textual patterns in this corpus and cannot establish causal relationships, authorship in disputed cases, or general differences between human and AI writing.

Future research may expand the corpus to include larger and more diverse groups of students, different educational levels, and multiple argumentative writing tasks. Researchers could also generate several AI essays using standardized prompts and multiple models to account for output variability. Such designs would provide a stronger basis for examining whether the thematic, linguistic, and rhetorical patterns identified here recur across writing conditions.

Subsequent studies may incorporate in-class writing exercises, reflective journals, interviews, oral defenses, and successive drafts to provide complementary evidence of students' understanding and composing practices. These sources would allow researchers to distinguish more carefully between features of final written products and the processes through which students develop arguments.

Another direction is to use persuasive essay topoi as prompts for focused investigations of argumentative and thematic development. Such prompts may facilitate systematic examination of how students establish claims, provide supporting relationships, address opposing positions, and organize related propositions through thematic progression.

Finally, research incorporating process evidence, such as revision histories, screen recordings, and think-aloud protocols, could provide a more direct account of how students interact with AI tools during composition. This would help distinguish independently produced writing from AI-assisted composition without relying on textual features alone.

8. Declarations

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8.2 Declaration of competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

8.3 Declaration of generative AI and AI-assisted technologies

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) for language editing, restructuring, and drafting assistance. The authors reviewed and verified all revisions, references, interpretations, and factual statements and take full responsibility for the final content.

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Appendix A

Artificial Intelligence's Response

Artificial Intelligence (AI) is one of the most influential technological developments of the modern era. As it becomes more integrated into everyday life, many people question whether AI will improve or threaten future job opportunities. While it is true that AI may replace certain jobs, overall it is more likely to improve job opportunities by creating new roles, increasing productivity, and transforming the nature of work rather than eliminating it entirely.

One major concern is that AI can automate repetitive and routine tasks, which may lead to job losses in areas such as manufacturing, data entry, or customer service. Machines can work faster, make fewer errors, and operate continuously without fatigue.

This can be threatening for workers whose jobs rely heavily on predictable tasks. However, this kind of technological change is not new. In the past, inventions such as the industrial machine and the computer also replaced certain jobs, yet they eventually created new industries and employment opportunities.

AI also has the potential to significantly improve job opportunities by creating entirely new careers. Fields such as AI development, data science, robotics, cybersecurity, and AI ethics did not exist a few decades ago. As AI continues to grow, there will be increased demand for people who can design, manage, and improve these systems. Additionally, AI can support jobs in healthcare, education, and science by helping professionals make better decisions, analyze complex data, and save time, allowing them to focus on creative and human-centered tasks.

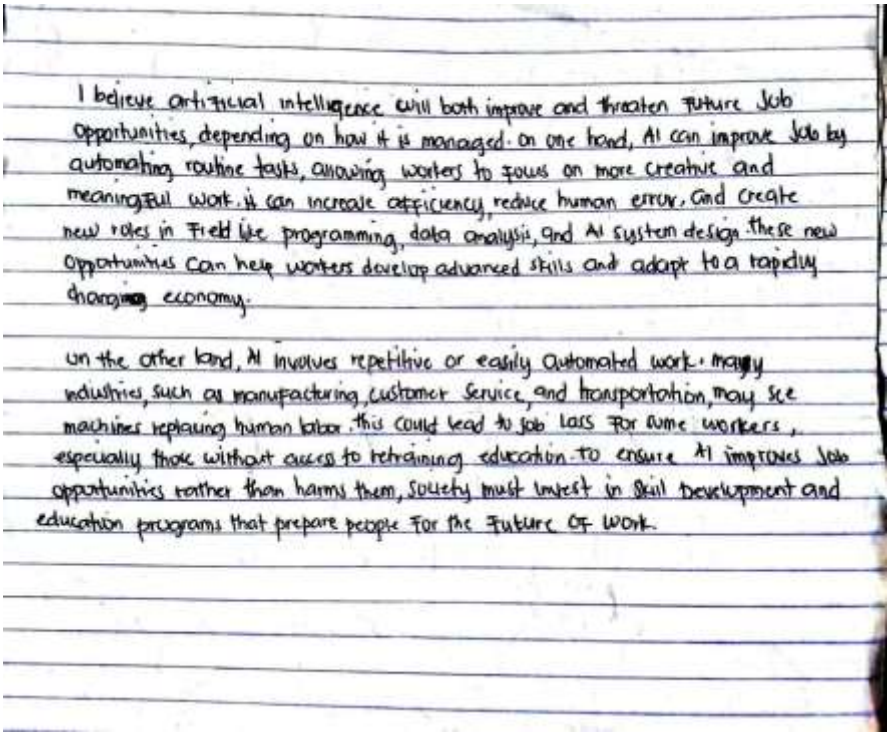
Furthermore, AI can enhance productivity and job quality. By handling boring or dangerous tasks, AI allows humans to concentrate on work that requires critical thinking, creativity, emotional intelligence, and problem-solving. These are skills that machines cannot fully replace. For example, teachers can use AI tools to personalize learning, while doctors can rely on AI to assist in diagnosing diseases more accurately. In this way, AI acts as a supportive tool rather than a replacement.

In conclusion, while AI does pose challenges and may threaten certain types of jobs, its overall impact on future job opportunities is more positive than negative. The key factor will be how societies adapt through education, skill development, and responsible use of

technology. If people are prepared to learn new skills and work alongside AI, it can become a powerful force for improving employment and shaping a more innovative future.

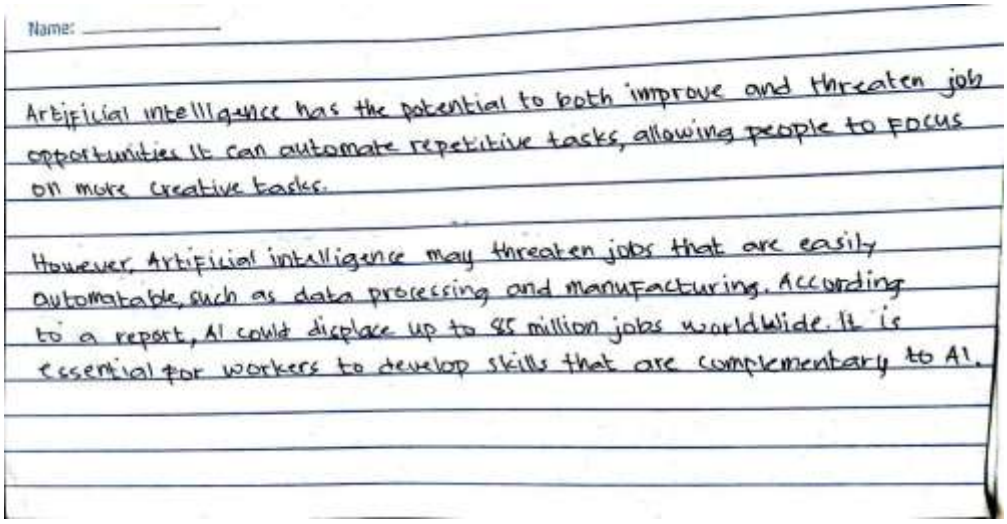
Appendix B

Samples of Student-Written Essays



I believe artificial intelligence will both improve and threaten future job opportunities, depending on how it is managed. On one hand, AI can improve jobs by automating routine tasks, allowing workers to focus on more creative and meaningful work. It can increase efficiency, reduce human error, and create new roles in field like programming, data analysis, and AI system design. these new opportunities can help workers develop advanced skills and adapt to a rapidly changing economy.

On the other hand, AI involves repetitive or easily automated work. many industries, such as manufacturing, customer service, and transportation, may see machines replacing human labor. this could lead to job loss for some workers, especially those without access to retraining education. to ensure AI improves job opportunities rather than harms them, society must invest in skill development and education programs that prepare people for the future of work.



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Artificial intelligence has the potential to both improve and threaten job opportunities. It can automate repetitive tasks, allowing people to focus on more creative tasks.

However, Artificial intelligence may threaten jobs that are easily automatable, such as data processing and manufacturing. According to a report, AI could displace up to 85 million jobs worldwide. It is essential for workers to develop skills that are complementary to AI.

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