



Developing Academic Writing in Health Science Education: A Mixed-Methods Study of Cohesion and Coherence in ESL Student Essays at Bibiani College of Health Sciences, Ghana

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<http://dx.doi.org/10.47814/ijssrr.v9i7.3397>

Abstract

Mastering cohesion and coherence is essential for effective academic writing; however, it continues to be a persistent challenge for learners of English as a second language in health science education. This study examined the use of cohesive and coherent devices in the essays of first-year students at Bibiani College of Health Sciences, Ghana. Utilizing a concurrent mixed-methods design, the study examined 30 randomly selected expository essays from an initial purposive sample of 67 students and performed semi-structured interviews with 12 students and five English instructors. Quantitative analysis revealed a dominant reliance on grammatical cohesion—particularly “reference” (48.2%) and “conjunctions” (31.5%)—with limited use of lexical cohesion, substitution, and ellipsis. Pearson correlation results confirmed a significant positive relationship between lexical cohesion diversity and coherence scores ($p < 0.05$). Qualitative findings indicated that students’ writing challenges stem from limited vocabulary, cognitive overload from content-heavy coursework, and list-based instructional practices that emphasize connectors over functional discourse use. Teachers reported constraints such as limited instructional time and insufficient genre-based modeling. The study concludes that current pedagogical approaches do not adequately support the development of advanced discourse competence. It recommends explicit lexical instruction, genre-based writing pedagogy, and structured feedback mechanisms to strengthen cohesion and coherence in health-science academic writing.

Keywords: Cohesion and Coherence; Lexical and Grammatical Cohesion; ESL Academic Writing; Health-Science Education; Mixed-Methods Research

1. Introduction

The ability to produce clear, logically structured, and unified academic text is a central indicator of communicative competence in higher education. In English as a Second Language (ESL) contexts, cohesion and coherence serve as the linguistic and conceptual frameworks that convert isolated sentences

into coherent discourse. Cohesion refers to the grammatical and lexical devices that create explicit links across clauses and sentences, while coherence concerns the underlying logical organization that enables readers to follow the writer's intended message (Halliday & Hasan, 2014). For students attending professional institutions like the Bibiani College of Health Sciences (BCHS), these competencies encompass more than just academic achievement. They are foundational to future professional tasks, including clinical documentation, patient-care reporting, and administrative communication. As health-science writing requires precision, clarity, and terminological accuracy, the ability to construct coherent and cohesive texts becomes an essential component of disciplinary literacy and professional readiness. Despite the importance of these skills, many ESL learners in Ghana—particularly those in health-focused tertiary institutions—struggle to transition from basic sentence-level accuracy to advanced discourse-level organization. This difficulty often results in essays that are grammatically correct in isolation but lack thematic progression, logical sequencing, and semantic clarity.

Preliminary observations at BCHS reveal recurring patterns of mechanical repetition, ambiguous referencing, and overreliance on basic conjunctions such as “and,” “also,” and “because.” These patterns suggest that while students may possess the linguistic resources to construct individual sentences, they lack the cohesive strategies required to integrate ideas into a unified whole. The research problem therefore centers on the declining quality of academic writing among first-year BCHS students, manifested in fragmented discourse structures, limited lexical variety, and weak logical connectivity. This problem raises critical questions about the specific cohesive devices' students use, the nature of the errors they make, and the extent to which current instructional practices support or hinder their development.

This study addresses a clear gap in the literature by examining cohesion and coherence within the specialized context of health-science education—a domain where language instruction is often secondary to technical training. Although global research has extensively explored cohesion in general ESL settings, far less attention has been given to discipline-specific writing environments where cognitive load, content density, and specialized vocabulary shape students' discourse performance. The pedagogical ecology of BCHS—marked by content-heavy curricula, limited instructional time for language development, and high cognitive demands—creates structural conditions that intensify these challenges. Consequently, this study argues that cohesion and coherence difficulties among health-science ESL learners are not merely linguistic shortcomings but are produced through the interaction of instructional practices, cognitive load constraints, and restricted disciplinary lexical development. To address this problem, the study investigates three core questions: (1) Which cohesive devices do first-year BCHS students employ in their academic essays? (2) What errors or misuse patterns characterize their application of these devices? (3) What instructional strategies do English language teachers use to support students' development? By integrating quantitative analysis of student essays with qualitative insights from teachers and learners, the study generates new empirical evidence for applied linguistics and provides a foundation for targeted pedagogical interventions aimed at strengthening academic writing and professional communication among health-science trainees.

A deeper examination of cohesion and coherence within ESL academic writing also requires situating the problem within broader theoretical and disciplinary frameworks. Contemporary research in applied linguistics emphasizes that writing development is not merely a linguistic process but a cognitively and socially mediated activity shaped by instructional design, disciplinary expectations, and learners' prior knowledge structures. In health-science education, these dynamics are intensified because students must simultaneously acquire specialized terminology, conceptual schemas, and procedural knowledge while learning to express these ideas in a linguistically coherent manner. Moreover, when learners are required to process dense technical content, their working memory becomes overloaded, reducing the cognitive resources available for managing discourse-level features such as cohesive chains, logical transitions, and thematic progression. Research on the reading–writing connection further demonstrates that coherence is strongly influenced by the depth of students' disciplinary reading, as exposure to well-structured texts

enhances their internal models of academic discourse. Within this context, the writing challenges observed at BCHS reflect not only linguistic limitations but also the complex interplay between cognitive demands, disciplinary literacy, and pedagogical practices, which can hinder students' ability to produce coherent and well-structured academic texts in health sciences. This calls into question a more integrated approach to writing instruction that aligns linguistic development with the epistemic and communicative norms of the health sciences, suggesting that such an approach could improve students' ability to manage discourse-level features in their writing.

This study also contributes to lifelong language education by examining how foundational academic writing skills develop within professional training environments. By placing cohesion and coherence within the larger framework of lifelong learning, the study illustrates how early disciplinary writing practices influence students' long-term communicative competence, professional identity development, and ability to engage in continuous knowledge acquisition. The findings highlight that writing challenges in health-science education are not merely linguistic deficits but indicators of deeper pedagogical, cognitive, and institutional dynamics that influence learners' engagement with academic discourse, such as the need for improved teaching methods and support systems that address these underlying issues. In doing so, the study offers evidence that can inform curriculum design, teacher preparation, and institutional strategies aimed at strengthening disciplinary literacy across the educational lifespan. These insights are particularly relevant for educators, policymakers, and academic leaders seeking to enhance learning outcomes, promote equitable access to high-quality language education, and support the development of competent, reflective professionals within health-science and adult-learning contexts.

This study argues that cohesion and coherence challenges among health-science ESL learners arise from the interaction of instructional practices, cognitive load, and limited lexical resources. These factors can hinder learners' ability to communicate and interpret complex health-related texts, ultimately affecting their academic performance and professional readiness. Moreover, these constraints operate within a discipline where precision, terminological accuracy, and the ability to synthesize multimodal information are central to safe and effective practice. Weaknesses in discourse competence not only make academic writing harder but also limit students' ability to communicate effectively in clinical reasoning, work with other professionals, and interact with patients. This intensifies the challenge of designing teaching methods that link language development with the epistemic and communicative norms of health-science fields. It also raises questions about how such methods can better prepare students for clinical reasoning, particularly in terms of integrating language skills with critical thinking and decision-making processes essential in clinical settings. In addition, it emphasizes the necessity of approaches that support collaboration with other professional groups, for example, through case studies and joint projects that mirror real-world practice. These limitations underscore the convergence of linguistic, cognitive, and disciplinary demands in health science education, establishing discourse competence as not only a linguistic outcome but also an essential element of professional competence.

2. Literature Review

2.1 Theoretical Background

Understanding how students construct coherent texts requires an integrated account of linguistic cohesion, cognitive processing constraints, and domain knowledge. In this study, cohesion—operationalized through reference, conjunction, lexical cohesion, substitution, and ellipsis—is treated as the linguistic mechanism that enables writers to build textual connectivity. This mechanism is theorized through Halliday and Hasan's (2014) cohesion framework, cognitive load theory (Sweller et al., 2019), and the knowledge effect (Cervetti et al., 2016; Cervetti & Wright, 2020), which together explain how linguistic resources, cognitive effort, and background knowledge jointly shape coherence. In this context, coherence is defined not merely by the existence of cohesive devices but by the efficacy with which writers utilize these resources in conjunction with their cognitive and knowledge frameworks during

disciplinary writing assignments. Cohesion shows the visible language features, but coherence comes from how these features work together with the writer's ability to handle mental effort and use relevant knowledge. This taxonomy therefore offers a systematic means of examining how students construct “texture”—the property that transforms discrete sentences into a unified, meaning-bearing discourse. Subsequent research has broadened this framework by differentiating cohesion as a textual attribute and coherence as a cognitive occurrence. Widdowson (1978) emphasized that coherence arises not solely from linguistic markers but from the reader's ability to interpret and integrate ideas. This distinction is particularly relevant in ESL contexts, where students may produce texts that are formally cohesive yet lack logical clarity due to limited background knowledge or insufficient organizational strategies. Adem and Berkessa (2022) and Smith et al. (2021) further argue that coherence depends heavily on the reader's prior knowledge, reinforcing the idea that linguistic cohesion alone cannot guarantee comprehensibility.

Research on cohesion in academic writing has consistently shown that students often rely on surface-level cohesive markers without achieving deeper logical structuring. Suwandi (2016), in an analysis of undergraduate abstracts, found that students frequently used conjunctions correctly but struggled with the logical arrangement of ideas, resulting in texts that were cohesive but not coherent. Similar patterns have been observed in Ghanaian ESL contexts, where additive conjunctions such as “and” and “also” are commonly overused as compensatory strategies for limited syntactic and lexical resources. Medve and Takač (2013) demonstrated that while cohesion contributes to text quality, the effectiveness of cohesive devices depends on their appropriateness rather than their frequency. Their findings align with Douglas's (2025) broader argument that language proficiency involves both organizational and pragmatic competence. McNamara et al. (2011) also found that people often have trouble understanding texts when they have too many or too few cohesive ties. This suggests that the best level of cohesion depends on the type of text, the reader's level of understanding, and what they already know. These studies collectively highlight the complexity of cohesion and coherence in ESL writing and emphasize the necessity of instructional approaches that address both linguistic form and cognitive processing.

A growing body of research has examined the role of cognitive load in writing performance. Sweller et al. (2019) contend that learners possess a restricted working memory capacity; consequently, when cognitive resources are allocated to content-intensive tasks, diminished resources are available for the management of linguistic structures, such as cohesive chains. This is especially important in health science education, where students must remember technical terms, disease symptoms, and procedural knowledge while also writing clear and logical essays. Cook and O'Brien (2015) add that weak cohesion increases the inferential burden on readers, suggesting that writers with limited cognitive resources may default to simpler cohesive strategies. The relationship between vocabulary knowledge and coherence has also been widely documented. Castles et al. (2018) emphasize the importance of extensive reading for developing lexical depth, while Cervetti et al. (2016) describe the “knowledge effect,” in which domain knowledge enhances conceptual and linguistic coherence. Cervetti and Wright (2020) further argue that comprehension and vocabulary acquisition are mutually reinforcing, indicating that students with broader disciplinary knowledge are better equipped to construct coherent texts.

Instructional interventions aimed at improving cohesion and coherence have produced mixed results. Elleman's (2017) meta-analysis on inference instruction demonstrated that explicit teaching of inferencing skills improves both literal and inferential comprehension, suggesting potential benefits for writing as well. Stevens et al. (2019) reviewed summarizing and main idea interventions and found that structured summarization tasks help students develop more concise and lexically varied writing. However, most of these interventions have been tested in general education or liberal arts contexts, leaving a gap in research on discipline-specific writing instruction for health science students. Ramesh and Sanampudi (2022) highlight the increasing role of automated essay scoring systems, which often reward lexical diversity and penalize mechanical repetition—patterns relevant to the present study. Even with these new technologies, Tabari and Johnson (2023) say that many teachers still teach cohesion by

giving students lists of transition markers. Such practices may not be the most effective means to foster deeper coherence among students, particularly in health science writing, where adherence to specific rules and expectations is vital for clear communication. They may ignore the importance of context and idea synthesis, which are vital for skilled writing in this field, leading to a lack of effective communication and understanding of complex health science concepts. This study addresses existing gaps by investigating cohesion and coherence within the distinctive linguistic and cognitive context of a health science college, where disciplinary knowledge, vocabulary requirements, and pedagogical approaches converge to influence writing. These structures position cohesion as a surface linguistic system, coherence as a cognitively mediated construct and writing performance as the outcome of their interaction under instructional and disciplinary constraints.

2.2 Conceptual Framework



Figure 1: Integrated Conceptual Model

Figure 1 presents the integrated conceptual model guiding this study, structured around a four-stage developmental pathway: instructional input, learner resources, writing performance, and coherence outcome. This framework explains how cohesion and coherence develop in the academic writing of first-year health-science students by illustrating how pedagogical conditions, cognitive and linguistic capacities, and observable writing behaviors interact to shape discourse quality. It positions writing development as a dynamic process in which instructional practices influence learners' internal resources, which in turn determine the effectiveness of their writing performance and ultimately the coherence of the final text. Instructional input represents the pedagogical conditions that determine students' exposure to cohesive devices and discourse-level writing strategies. Prior studies indicate that cohesion is frequently taught through list-based instruction, where learners receive sets of connectors without explicit attention to semantic nuance or discourse function (Adem & Berkessa, 2022; Tabari & Johnson, 2023; Widdowson, 1978). Such approaches emphasize the presence of cohesive markers rather than their strategic deployment. Research by Stevens et al. (2019) and Saimon et al. (2023) further demonstrates that lexical cohesion—collocations, lexical bundles, and domain-specific synonyms—is often underemphasized in ESL classrooms. McNamara et al. (2011) also note that limited genre-based modeling restricts students' ability to understand how cohesive devices operate within authentic disciplinary texts. These instructional conditions shape the cohesive resources students acquire and directly influence the quality of their subsequent writing performance.

Learner resources refer to the internal cognitive and linguistic capacities that mediate how instructional input is processed. Vocabulary depth, lexical access, and semantic flexibility are central to producing varied and meaningful cohesive ties (Castles et al., 2018; Smith et al., 2021). Domain knowledge also contributes to conceptual coherence, as students with stronger background knowledge form more accurate and meaningful connections between ideas (Cervetti et al., 2016). Cognitive load theory (Sweller et al., 2019) suggests that health-science students—who must simultaneously manage technical terminology, conceptual schemas, and procedural knowledge—often experience reduced working-memory capacity for discourse-level tasks. Content processing consumes cognitive resources, leaving fewer available for managing cohesive chains, referential clarity, or logical transitions. Thus, learner resources function as the mediating mechanism through which instructional input is transformed into writing performance. Writing performance signifies the discernible linguistic and structural results arising from the interplay between instructional input and learner resources. This includes the frequency, accuracy, and appropriateness of cohesive devices, drawing on Halliday and Hasan's (2014) taxonomy and subsequent applications such as Suwandi (2016). Writing performance also encompasses coherence ratings and textual clarity, which Medve and Takač (2013) identify as core indicators of overall text quality. Common error patterns—mechanical repetition, ambiguous reference, and conjunction misuse—serve as diagnostic

markers of underlying linguistic limitations or cognitive strain. Within this model, lexical cohesion diversity emerges as a key predictor of coherence, reflecting students' ability to create semantic continuity across the text. Conversely, overreliance on simple grammatical cohesion signals restricted vocabulary, insufficient instructional exposure, or cognitive overload.

The coherence outcome represents the culminating effect of the entire pathway and reflects the degree to which a text achieves logical organization, semantic clarity, and discourse unity. In this framework, coherence is not treated as a surface-level textual feature but as an emergent property resulting from aligned instructional practices, sufficient learner resources, and effective writing performance. When any stage of the pathway is weakened—whether through limited pedagogical support, constrained cognitive capacity, or underdeveloped writing skills—the coherence of the final text is compromised. The model therefore conceptualizes cohesion and coherence as products of the dynamic interplay between teaching conditions, learner capacities, and disciplinary writing demands, offering a structured lens through which to interpret the writing challenges observed among first-year health-science students.

3. Method

3.1 Research Design and Philosophical Background

This study employed a concurrent mixed-methods research design, in which quantitative and qualitative data were collected during the same phase of the research process, analyzed independently, and subsequently integrated at the stage of interpretation. The choice of this design was motivated by the need to generate both statistically robust evidence and contextually grounded explanations regarding the use of cohesion and coherence in student writing. The quantitative aspect concentrated on the statistical distribution and frequency of cohesive devices in student essays, whereas the qualitative aspect examined the perceptions, cognitive processes, and pedagogical experiences of both students and instructors. The integration of the quantitative and qualitative strands enabled a multi-layered analytic architecture in which numerical patterns in cohesive-device use were systematically interpreted alongside participants' explanatory accounts. This cross-validation of findings enhanced the study's internal validity by enabling convergent evidence to corroborate or refine patterns identified in the essays. More importantly, the combined design generated interpretive depth: quantitative results identified what students did in their writing, while qualitative insights illuminated why those patterns emerged and how instructional practices shaped them.

The study was anchored in the pragmatic philosophical paradigm, which supports methodological pluralism and the integration of post-positivist and constructivist approaches. Pragmatism posits that a single epistemological perspective cannot fully comprehend complex educational phenomena, such as writing competence. In this context, quantitative data obtained from textual analysis were regarded as objective measures of structural writing proficiency, while qualitative data from interviews illuminated the subjective and instructional factors influencing that proficiency. This dual orientation enabled a more comprehensive understanding of both the observable patterns in student writing and the underlying mechanisms that produce them. The study attained a degree of explanatory power by correlating the structural characteristics of texts with the cognitive and pedagogical contexts of their production, a synergy unattainable by either component in isolation.

The research design was guided by three interrelated research questions: first, to identify the cohesive and coherent devices most frequently utilized in health-related essays written by first-year students; second, to examine the common patterns of error in the application of these devices that impede textual clarity; and third, to analyze the extent to which current pedagogical practices address these challenges. These questions were operationalized through two testable hypotheses. The first hypothesis (H_1) posited that there exists a statistically significant positive relationship between the diversity of lexical cohesive devices—such as synonyms, hyponyms, and collocations—and the overall coherence scores assigned to

student essays by independent evaluators. The second hypothesis (H_2) proposed that students rely significantly more on grammatical cohesion, particularly reference and simple conjunctions, than on lexical cohesion or complex logical connectors, reflecting a tendency toward surface-level text construction. These hypotheses informed the selection of variables, the design of measurement procedures, and the choice of statistical analyses.

3.2 Participants, Setting, and Sampling Procedures

The research was carried out at BCHS in Ghana's Western North Region, concentrating on first-year students enrolled in the 2022/2023 academic year. The target population consisted of approximately 350 students distributed across six instructional classes. This population was selected due to its relevance to the research objectives, as first-year students are in the early stages of developing academic writing competence and are therefore more likely to exhibit identifiable patterns in the use of cohesion and coherence. A total sample of 67 students was initially identified through purposive sampling, comprising 30 male and 37 female participants. All participants had completed at least one semester of Communication Skills (CS 101), thereby ensuring a baseline level of exposure to academic writing conventions. However, for the purposes of detailed textual analysis and statistical consistency, a subset of 30 essays was selected through a simple random sampling procedure, with five students drawn from each of the six classes. This dual-stage sampling strategy allowed for both broader representational coverage and more rigorous quantitative analysis within manageable analytical constraints. The sample size was considered adequate for exploratory mixed-methods research, allowing for meaningful statistical analysis while maintaining feasibility for detailed qualitative interpretation. For the qualitative component, 12 students were purposively selected from the sampled cohort to participate in semi-structured interviews, ensuring representation across classes and variation in writing ability. This sampling strategy allowed the study to capture a spectrum of learner experiences, ranging from students who demonstrated strong control of cohesive devices to those who struggled with basic textual organization. Five seasoned English language instructors were also included to offer a pedagogical viewpoint on the instruction of cohesion and coherence, thereby contextualizing student performance within the educational framework of the institution. The inclusion of both groups enabled a multi-level analysis that linked observable patterns in student writing to the instructional practices, constraints, and pedagogical philosophies articulated by teachers. This dual-perspective design enhanced the interpretive capacity of the qualitative strand by elucidating both the way students write and the reasons behind specific patterns of cohesion and coherence that arise within the BCHS learning environment.

3.3 Instruments and Data Collection Procedures

Data collection was conducted using two primary instruments designed to capture both the product of writing and the processes underlying it. The first instrument was a controlled writing assessment in which students were required to produce a 500-word expository essay on the topic: *"The Impact of Sanitation on Community Health: Challenges and Solutions."* This topic was selected to elicit a health-specific academic register while requiring the use of diverse logical connectors, including causal, additive, and contrastive relations. The controlled nature of the task ensured comparability across responses, while the absence of immediate instructional support allowed for the assessment of students' independent writing competence. Furthermore, the task design minimized external variability by standardizing time limits, writing conditions, and prompt interpretation, thereby strengthening the internal validity of the writing sample. The prompt also aligned with the disciplinary orientation of the institution, ensuring that students engaged with content that was both familiar and cognitively demanding. This alignment enhanced the ecological relevance of the writing task and provided a realistic context for evaluating students' deployment of cohesive and coherent devices.

Each essay was treated as a discrete unit of analysis and subsequently segmented into sentences and paragraphs to facilitate systematic coding. This segmentation enabled fine-grained identification of

cohesive ties and allowed the analysis to capture how students constructed meaning at both micro- and macro-textual levels. The expository genre was intentionally selected because it demands explicit organization, hierarchical structuring of ideas, and the deliberate deployment of cohesive devices—features that make it an ideal site for examining the interaction between grammatical and lexical cohesion. Moreover, expository writing mirrors the communicative demands students will encounter in academic and professional health science contexts, thereby increasing the ecological validity of the task. Treating essays as independent analytic units also allowed for cross-case comparison, enabling the study to identify recurring patterns, individual variation, and potential instructional gaps across the cohort. This structured approach ensured that the resulting dataset was sufficiently rich to support both quantitative frequency analysis and qualitative interpretive work. The second instrument consisted of semi-structured interview protocols administered to both students and instructors. Student interviews examined their awareness and use of cohesive devices, the difficulties they experienced in writing, and the strategies they used to organize ideas. These accounts offered insight into the cognitive and metacognitive processes shaping their written performance. Teacher interviews explored instructional approaches, including the extent to which cohesion and coherence were taught explicitly or implicitly, as well as the challenges encountered in developing students' writing skills within the constraints of the curriculum. Including both groups allowed the study to triangulate textual evidence with lived experiences, revealing how instructional practices, learner beliefs, and classroom conditions shape the development of cohesive writing. This dual-perspective design also made it possible to identify misalignments between what teachers report teaching and what students internalize and apply in their writing. All interviews were audio recorded with informed consent, transcribed verbatim, and anonymized to ensure confidentiality, thereby maintaining ethical integrity and enabling rigorous thematic analysis.

3.4 Data Coding and Measurement Procedures

The analysis of student essays was guided by the cohesion framework proposed by Halliday and Hasan (2014), which categorizes cohesion into reference, substitution, ellipsis, conjunction, and lexical cohesion. According to this taxonomy, reference was divided into personal, demonstrative, and comparative forms. Conjunctions were divided into additive, adversative, causal, and temporal relations. Lexical cohesion was examined through reiteration (repetition, synonymy, hyponymy, and superordinate terms) and collocation, with particular attention to the formation, continuity, and density of lexical chains across the text. This approach allowed the analysis to capture not only surface-level cohesion but also deeper semantic connectivity and thematic development. Essay coding followed a detailed codebook adapted from Halliday and Hasan's (2014) model for written expository texts. The codebook provided explicit operational definitions, boundary conditions, and decision rules for each cohesive category, ensuring consistency across coders. Each cohesive tie was recorded as a discrete unit, enabling precise quantitative analysis. For lexical cohesion, chains were identified and their length, distribution, and internal structure were documented to capture how students maintained semantic continuity across paragraphs. For reference and conjunctions, each token was tallied and mapped to its functional role within the sentence or discourse segment. All coded data were entered into a structured spreadsheet keyed to anonymized essay IDs.

To evaluate the reliability of the coding procedure, 20% of the essays were independently coded by a second trained rater. Inter-rater agreement for categorical classifications (e.g., type of cohesive device) was quantified using Cohen's kappa coefficient (Rau & Shih, 2021), expressed as $k = (Po - Pe) / (1 - Pe)$, where Po = observed proportion of agreement and Pe = expected proportion of agreement by chance. For continuous measures such as frequency counts and lexical chain lengths, inter-rater reliability was assessed using the intraclass correlation coefficient (ICC), based on a two-way random-effects model for absolute agreement (ICC[2,1]). Reliability thresholds followed established conventions in discourse-analytic research, with $\kappa \geq 0.60$ interpreted as substantial agreement and $ICC \geq 0.75$ indicating excellent reliability. Collectively, these indices ensured that both categorical classifications and continuous measures were consistently coded and minimized the risk of systematic rater bias. In addition to cohesion

analysis, each essay was evaluated for overall coherence using a holistic rating scale applied by two independent raters who were blind to student identity. The coherence rubric operationalized key dimensions of discourse quality, including the clarity of the thesis, logical progression of ideas, paragraph unity, global organization, and effective use of transitional devices. Coherence scores were treated as continuous variables and inter-rater reliability was again assessed using the ICC to ensure that coherence judgments reflected stable evaluative criteria rather than subjective variation between raters. The cohesion coding system, lexical chain analysis, and coherence rating procedures provided a comprehensive and methodologically rigorous framework for examining the textual quality of student writing. The use of clear definitions, organized categorization, and reliable checks made sure that the final dataset was both reliable and appropriate for in-depth analysis.

3.5 Data Analysis Procedures

The study employed an integrated analytic strategy combining quantitative and qualitative procedures to generate a comprehensive understanding of students' use of cohesion and coherence. Quantitative analyses provided systematic measurement of cohesive device frequency and distribution, while qualitative analyses illuminated the cognitive, pedagogical, and rhetorical processes underlying students' writing behaviors. By integrating these strands, we achieved a multilayered interpretation of the data, contextualizing statistical patterns within the instructional environment and learner experiences. Quantitative data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 26. Descriptive statistics were first computed to summarize the frequency and distribution of cohesive devices across essays (Mishra et al. (2019). Measures of central tendency (means and medians) and measures of dispersion (standard deviations and ranges) were calculated to characterize variability in cohesion usage and coherence scores. These descriptive outputs established an empirical foundation for discerning prevailing patterns, anomalies, and prospective areas of instructional concern. Inferential statistical analyses were then conducted to test the study's hypotheses. The relationship between lexical cohesion diversity and coherence scores was examined using Pearson's product-moment correlation coefficient, expressed as $r = \frac{\sum(X - \bar{X})(Y - \bar{Y})}{\sqrt{[\sum(X - \bar{X})^2 \cdot \sum(Y - \bar{Y})^2]}}$, where X = lexical cohesion diversity, Y = coherence scores, and $\bar{X}$ and $\bar{Y}$ = their respective means. Prior to analysis, assumptions of normality, linearity, and homoscedasticity were assessed using Shapiro-Wilk tests, quantile-quantile plots (QQ plot), and scatterplots (Oldford, 2016; Shatz, 2024)). When these assumptions were violated, Spearman's rank correlation coefficient (ρ) was used as a non-parametric alternative to ensure analytic robustness (Sedgwick, 2014). Differences in cohesion usage across demographic groups (e.g., sex, age band, qualification) were analyzed using one-way analysis of variance (ANOVA), depending on the number of comparison groups (Quirk, 2021). In instances where parametric assumptions were unmet, a non-parametric alternative, specifically the Mann-Whitney U test, was utilized (MacFarland & Yates, 2016). Statistical significance was evaluated at $\alpha = 0.05$, and effect sizes (Cohen's d) were reported to reveal the magnitude and practical significance of observed relationships. This combination of descriptive and inferential techniques ensured that the quantitative strand captured both the prevalence and the functional relevance of cohesive device use.

Qualitative data were analyzed using a structured thematic analysis framework involving multiple stages of coding and interpretation. The analysis began with familiarization, during which transcripts were read repeatedly to develop an overall understanding of participants' perspectives. Next came open coding, in which meaningful parts of the text were given labels based on their meaning. Axial coding was then used to group related codes into broader conceptual categories, enabling the identification of patterns across participants. Finally, selective coding facilitated the integration of these categories into coherent thematic structures that captured the underlying logic of students' and teachers' experiences. Both deductive and inductive approaches were employed. Deductive codes were derived from the research questions and theoretical framework, focusing on issues such as pedagogical practices, instructional constraints, and writing challenges. Inductive codes emerged organically from the data, capturing unexpected insights such as students' reliance on memorized writing templates or teachers' limited instructional time for

explicit cohesion instruction. This dual coding strategy ensured that the analysis remained theoretically grounded while still being open to novel findings. Elements of text mining were applied to identify recurring lexical patterns and rhetorical structures in student writing. These patterns were analyzed through the lens of cognitive processing theories, especially the idea of passive activation, which explains how missing or weak cohesive links can leave the reader with gaps in their understanding. This theoretical lens helped clarify why certain essays appeared fragmented or difficult to follow despite containing grammatically correct sentences. The qualitative findings were integrated with the quantitative results during interpretation. This made it possible to explain statistical patterns, like the overuse of additive conjunctions or the limited use of lexical chains, in terms of how teachers taught, what students believed, and how their brains worked. The combined analytic approach thus provided a richer and more in-depth comprehension of the factors shaping cohesion and coherence in students' writing. By examining how teachers conceptualized cohesion and how students internalized these instructional cues, the integrated analysis revealed structural mismatches between pedagogical intentions and learner uptake. It also enabled the identification of latent mechanisms—such as cognitive overload, limited lexical resources, or reliance on memorized templates—that could not be inferred from quantitative frequencies alone. The synthesis of evidence enhanced the study's interpretive depth by connecting observable textual features to the broader educational ecology that produced them.

3.6 Reliability, Validity, and Ethics

The study employed multiple strategies to ensure methodical rigor and to enhance the trustworthiness of both the quantitative and qualitative components. Reliability was strengthened using a detailed coding manual, standardized analytic procedures, and the calculation of inter-rater agreement statistics for both categorical and continuous variables. The use of Cohen's kappa and the ICC ensured that coding decisions were not idiosyncratic but reflected stable and replicable judgments across raters. Validity was reinforced through the integration of quantitative and qualitative strands, allowing patterns identified in the essay data—such as the overuse of additive conjunctions or the limited deployment of lexical chains—to be corroborated with insights from student and teacher interviews. This methodological integration enhanced construct validity, as the convergence of multiple data sources provided a more comprehensive and theoretically grounded understanding of cohesion and coherence in student writing. Despite these strengths, several limitations must be acknowledged to contextualize the findings. The quantitative sample, while adequate for descriptive and correlational analysis, was relatively small and drawn from a single institutional setting, which may constrain the generalizability of the results to other educational contexts. Additionally, the cross-sectional design captures writing performance at a single point and therefore cannot establish causal relationships between instructional practices and students' development of cohesive writing. These limitations do not undermine the value of the findings but emphasize the necessity of future longitudinal or multi-site studies to extend the evidence base. Ethical considerations were rigorously observed throughout the research process. Institutional approval was obtained prior to data collection, and all participants provided informed consent after being briefed on the study's purpose, procedures, and voluntary nature. Data were anonymized using coded identifiers, and all audio recordings and transcripts were stored securely to maintain confidentiality. Participants were informed of their right to withdraw at any stage without penalty, ensuring adherence to principles of autonomy and respect for persons. No identifiable personal or academic performance data were disclosed, and participation did not influence students' academic evaluation. These measures ensured that the study met established ethical standards for research involving human participants. The study employed clear and easily repeatable methods. Using Halliday and Hasan's (2014) cohesion taxonomy with clear coding methods and standard statistical techniques creates a strong basis for others to repeat the study in similar educational environments. All instruments, coding schemes, and analytical protocols are accessible upon request, allowing other researchers to replicate or expand the study with accuracy. This commitment to transparency not only strengthens the credibility of the present findings but also contributes to the cumulative advancement of research on cohesion, coherence, and academic writing development.

4. Findings

4.1 Quantitative Distribution of Cohesive Devices

A total of 1,244 cohesive devices were identified across the 67 student essays included in the analysis. Table 1 presents the full distribution of cohesive devices by category, subtype, absolute frequency, percentage contribution, and mean occurrence per essay. The results indicate that grammatical cohesion accounted for most cohesive ties observed in the corpus. Reference devices constituted the largest single category, with 600 instances, representing 48.2% of all cohesive markers and yielding a mean of 8.95 occurrences per essay. Conjunctions were the second most common type, with 392 examples (31.5%, $M = 5.85$). They included additive, causal, and temporal relationships. This distribution shows a clear concentration of cohesive resources within the grammatical domain, with references and conjunctions together comprising nearly four-fifths of all identified ties. Individual essays showed the relative proportions across categories, indicating that the dataset maintained the same approach to grammatical cohesion. Lexical cohesion accounted for 212 instances (17.1%, $M = 3.16$), including reiteration (repetition, synonymy, hyponymy, superordinate terms) and collocation. Substitution and ellipsis were comparatively rare, with 25 instances (2.0%) and 15 instances (1.2%) respectively, each averaging fewer than one occurrence per essay. The overall mean number of cohesive devices per script was 18.55, reflecting the combined contribution of grammatical and lexical cohesion across the dataset. The distribution of these less frequent categories indicates that nominal and verbal substitution, as well as clausal or nominal ellipsis, appeared only sporadically across the corpus. Their low frequencies also resulted in minimal variation across individual essays, with most scripts containing either zero or a single instance of these devices. This pattern is consistent across the dataset and reflects the narrow range and low dispersion values associated with these categories, as shown in Table 1.

Table 1. Distribution of cohesive devices in BCHS student essays

Cohesive Category	Sub-type	Frequency	%	M	SD
Reference	Pronouns, Demonstratives	600	48.2	8.95	2.10
Conjunction	Additive, Causal, Temporal	392	31.5	5.85	1.75
Lexical Cohesion	Reiteration, Collocation	212	17.1	3.16	1.20
Substitution	Nominal, Verbal	25	2.0	0.37	0.48
Ellipsis	Nominal, Clausal	15	1.2	0.22	0.41
TOTAL	—	1,244	100	18.55	3.05

The distribution of cohesive devices in BCHS student essays suggests that current instructional approaches emphasize surface-level cohesion, potentially limiting students' development of deeper discourse competence required in academic and professional communication, which is essential for effectively conveying complex ideas and arguments in their writing. The distribution of cohesive devices in BCHS student essays suggests that current instruction prioritizes surface-level cohesion. This emphasis may limit students' development of deeper discourse competence, which is essential for conveying complex ideas and arguments in academic and professional writing.

4.2 Error Analysis and Qualitative Evidence from Scripts

Errors in cohesion were examined across three analytic dimensions: "Misuse," "Overuse," and "Underuse." These dimensions were operationalized to capture the structural and functional deviations that occurred when students attempted to deploy cohesive devices in their essays. Misuse referred to instances where a cohesive device was present but functionally inappropriate, resulting in ambiguity or breakdowns in textual linkage. Overuse captured cases where a device was repeated excessively, often mechanically, without contributing to thematic progression. "Underuse" meant that there were no

expected cohesive ties, especially in situations where referential clarity or logical sequencing needed clear linking. Script excerpts were selected to illustrate each error type, paying attention to the specific linguistic forms involved and the immediate textual environment in which it occurred. These excerpts provide concrete evidence of how cohesion challenges manifested in student writing and offer a descriptive basis for understanding the distribution of error types across the corpus. The cases presented below reflect typical patterns observed in the dataset and are representative of the broader tendencies identified through systematic coding.

4.3 Misuse and Ambiguity in Reference

Misuse of reference was one of the most frequently observed error types, particularly in the deployment of personal and demonstrative pronouns. Students frequently employed pronouns without delineating a clear or immediate antecedent, leading to referential ambiguity both within and between sentences. This pattern aligns with what Cook and O'Brien (2015) describe as “processing interference,” where the reader must pause to determine the intended referent. Such ambiguity was evident in several scripts, including for example student script excerpt A: *“The health workers told the community members that they had to clean the gutters. They were very angry about the situation.”* In this excerpt, the pronoun “They” in the second sentence lacks a clearly identifiable antecedent, as both “health workers” and “community members” are plausible referents. The ambiguity arises because the syntactic structure is neutral between the groups and contextual clues are absent. This type of error was recorded consistently across multiple essays and typically occurred in contexts where students attempted to summarize events or describe interactions between groups. The recurrence of ambiguous reference forms contributed to localized breakdowns in clarity, even when the surrounding sentences were structurally well formed. Such ambiguity also indicates that students have not yet internalized the discourse-level expectation that referents must be recoverable without interpretive strain. Over time, these unresolved pronoun–antecedent relations accumulate, subtly eroding coherence even in otherwise grammatically accurate prose. It also reflects a broader difficulty with maintaining stable discourse referents, suggesting that students may be relying on sentence-level construction rather than tracking entities across stretches of text. As a result, readers are forced into repeated inferential repair, which interrupts coherence even when the narrative logic is otherwise intact.

4.4 Mechanical Repetition and Lexical Paucity

Mechanical repetition was identified in 64% of the scripts, making it one of the most prevalent cohesion-related issues. This error type occurred when students repeated the same lexical item multiple times within a short textual span, often due to limited access to synonyms, hyponyms, or paraphrastic alternatives. The repetition was typically unintentional and did not serve a rhetorical or emphatic function. Instead, it produced lexical monotony and restricted thematic development. A representative example is shown in student script excerpt B: *“Sanitation is very important for life. Adequate sanitation helps prevent diseases. People should practice sanitation every day because without sanitation we will die.”* In this excerpt, the noun “sanitation” appears four times across three sentences, with no attempt to vary the lexical choices. The absence of reiteration strategies such as substitution, superordinate terms, or descriptive paraphrases resulted in a narrow lexical field. This pattern was common in essays where students attempted to maintain topic focus but lacked the lexical resources to diversify expression. Mechanical repetition was coded as an error when it occurred in contexts where alternative lexical forms were available and would have contributed to smoother thematic progression. In these instances, mechanical repetition frequently indicated a failure in lexical retrieval, with students opting for the most secure item instead of engaging more extensive semantic networks. Its frequency across scripts suggests a systemic limitation in productive vocabulary range, which in turn constrains cohesion by preventing thematic layering and progression.

4.5 Misuse of Conjunctions (Logical Disconnect)

Misuse of conjunctions was another recurrent error type, particularly in the selection of logical connectors that did not align with the semantic relationship between clauses. Students frequently inserted conjunctions such as “however,” “therefore,” or “moreover” without regard for the logical function these markers perform. Local coherence disruptions occurred as the conjunction signaled a relationship—contrast, cause, addition—that the surrounding propositions did not support. Student script excerpt C illustrates this issue: “*Many communities do not have proper waste disposal systems. However, poor sanitation practices continue to increase the spread of diseases.*” Here, the conjunction “However” introduces a contrastive relation, yet the second sentence provides additional information rather than a contrasting idea. The expected connector would have been additive (e.g., “Moreover,” “In fact”). This mismatch between conjunction type and semantic relation was observed across numerous scripts and typically occurred when students attempted to elevate the perceived sophistication of their writing by inserting advanced connectors.

When the conjunction used didn't accurately show the relationship between the linked clauses, the resulting logical disconnects were marked as errors. These inappropriate connector choices also reveal that students may be relying on surface-level formulaic linking devices rather than understanding the semantic operations those devices perform. Overuse of high-prestige conjunctions suggests an attempt to emulate academic discourse without the underlying pragmatic control needed to deploy them accurately. As a result, the rhetorical flow becomes artificially segmented, forcing readers to reinterpret relationships that should have been immediately transparent. Over time, these mismatches accumulate into a broader coherence strain, even when sentence-level grammar remains intact. It also reflects a tendency to treat conjunctions as ornamental rather than functional, which means students may prioritize perceived sophistication over semantic precision. This pattern suggests limited meta-discourse awareness, as they are not yet monitoring how connectors shape reader expectations about logical flow. In turn, the misuse disrupts the interpretive rhythm of the text, forcing readers to recalibrate the intended relationship between ideas. Over multiple occurrences, these disruptions accumulate into a fragmented argumentative structure that undermines the writer's overall communicative intent.

4.6 Hypothesis Testing: Correlation Between Lexical Variety and Coherence

To evaluate H_1 , both descriptive and inferential statistical methods were employed sequentially to analyze the correlation between lexical cohesion diversity and coherence scores. Initially, descriptive statistics were calculated to determine the distributional properties of the variables. Lexical cohesion diversity, which is the number of different lexical cohesive devices (like synonymy, hyponymy, and collocation), showed moderate variability in the sample ($M = 3.16$, $SD \approx 1.20$). This means that the data was spread out enough to be useful for correlational analysis. Coherence scores exhibited adequate variability ($M \approx 3.40$, $SD \approx 0.85$) when measured on a continuous scale using a standardized rating rubric, suggesting that the dataset contained sufficient spread to detect potential associations. It is important to note that these values cannot be directly compared to the frequency-based means shown in Table 1. This is because coherence scores were measured on a limited rating scale, while cohesive device counts are based on unlimited frequency data. Preliminary assumption testing was conducted prior to inferential analysis. The normality of both variables was assessed using the Shapiro–Wilk test, supplemented by visual inspection of Q–Q plots, which indicated no substantial deviation from normal distribution. Linearity and homoscedasticity were examined through scatterplot analysis, revealing a positive and approximately linear relationship between lexical diversity and coherence scores. These conditions satisfied the assumptions required for the application of Pearson's product–moment correlation coefficient.

The correlation between lexical cohesion diversity (X) and coherence scores (Y) was calculated using $r = \Sigma(X - \bar{X})(Y - \bar{Y}) / \sqrt{\Sigma(X - \bar{X})^2 \cdot \Sigma(Y - \bar{Y})^2}$. The analysis yielded a statistically significant positive

correlation, $r = 0.68$, $p < 0.01$, indicating a strong association between lexical diversity and coherence. This result suggests that essays exhibiting a greater range of lexical cohesive devices tend to achieve higher coherence ratings. The magnitude of the correlation falls within the range typically interpreted as strong in applied linguistics research, thereby providing robust empirical support for H₁. Furthermore, the stability of the correlation across independently rated coherence scores, confirmed through high inter-rater reliability ($ICC \geq 0.75$), reinforces the consistency and validity of the observed relationship. To evaluate H₂, descriptive statistical analysis was conducted to examine the relative distribution of grammatical and lexical cohesion categories. As presented in Table 1, grammatical cohesion devices—specifically reference (48.2%) and conjunction (31.5%)—collectively accounted for 79.7% of all cohesive ties identified in the corpus. In contrast, lexical cohesion constituted only 17.1% of total cohesive devices, while substitution (2.0%) and ellipsis (1.2%) were minimally represented.

Measures of central tendency further confirmed this pattern. The mean frequency per essay for reference ($M = 8.95$) and conjunction ($M = 5.85$) substantially exceeded that of lexical cohesion ($M = 3.16$). Dispersion statistics revealed significant variability in the use of grammatical cohesion, indicating that although most students depended on these devices, the degree of reliance differed among individuals. Demographic variables did not appear to influence the distributional dominance of grammatical cohesion across the dataset. These descriptive findings collectively furnish unequivocal empirical validation for H₂, illustrating that students predominantly depend on grammatical cohesion rather than lexical cohesion or intricate logical connectors. The pattern aligns with the characterization of “surface-level” text construction, where cohesion is achieved primarily through structural linking devices rather than deeper semantic integration. Strong descriptive evidence supported H₂ well, as it pertains to proportional dominance rather than relational association. Conversely, H₁ required inferential testing. This distributional imbalance also suggests that students may be relying on grammatically encoded cohesion as a compensatory strategy to manage limited semantic range, indicating an underlying gap in their ability to construct meaning through richer lexical and conceptual integration.

4.7 Qualitative Findings: Teacher and Student Interviews

The thematic analysis of the interview data generated three distinct themes that gave descriptive insight into the instructional, linguistic, and cognitive conditions shaping students' use of cohesive devices. These themes emerged through systematic coding of teacher and student transcripts and reflected recurring patterns in how participants described their experiences with cohesion and coherence in academic writing. The first theme captured instructors' reliance on a “list based” instructional approach, in which cohesive devices were introduced as discrete lexical items rather than as semantically differentiated tools for structuring discourse. The second theme reflected students' consistent identification of vocabulary limitations as a primary barrier to producing cohesive texts, particularly in relation to lexical variety and paraphrasing. The third theme highlighted the cognitive demands associated with the health science curriculum, where students' attention to content knowledge appeared to influence the management of cohesive structures during writing tasks. Across all interviews, participants provided concrete examples of classroom practices, writing challenges, and cognitive pressures, offering a descriptive account of the contextual factors that corresponded with the patterns observed in the written scripts. These themes show how teaching methods, language tools, and mental effort come together to influence how students communicate, supporting the linked ideas suggested in the study's framework.

4.7.1 Theme 1: The “List Based” Teaching Approach

Across all five instructor interviews, cohesion instruction was consistently described as “list based,” with teachers reporting that they typically provide students with sets of transition markers such as “First,” “Secondly,” “Moreover,” and “In conclusion.” These lists were often delivered through handouts, chalkboard notes, or brief oral explanations, with limited time allocated to discussing the semantic distinctions or discourse functions associated with each connector. One instructor stated, “We give them

the connectors, but they use them like salt—just sprinkling them everywhere without knowing if they belong there.” Teachers noted that curriculum pacing and workload constraints limited opportunities for extended instruction on cohesion, resulting in a focus on naming connectors rather than demonstrating their appropriate use in context. Some instructors indicated that students were expected to incorporate these devices into their writing but were not provided with explicit guidance on how to match connectors to specific logical relationships. The interview data showed that instructors regarded cohesive devices as essential features of academic writing but tended to emphasize their presence rather than their functional accuracy. This theme provides a descriptive account of how cohesion is introduced and practiced within the instructional environment.

The interviews further suggested that this list-oriented approach inadvertently positions cohesion as a surface-level requirement rather than a meaning-making resource, reinforcing students’ tendency to treat connectors as decorative add-ons. Instructors acknowledged that without modeling how connectors operate within authentic texts, students struggle to perceive the underlying logical relations that cohesive devices are meant to signal. Some teachers also reflected that their limited training in discourse pedagogy contributed to a reliance on lists, as they lacked concrete strategies for teaching cohesion beyond enumeration. These insights highlight a structural gap between teachers’ recognition of cohesion’s importance and the instructional practices available to support its functional development. This pattern indicates that cohesion instruction is predominantly declarative rather than procedural, resulting in students gaining knowledge about connectors without cultivating the capacity to employ them strategically in discourse. This reflects a broader pedagogical misalignment in which linguistic form is foregrounded at the expense of discourse function, limiting students’ capacity to internalize cohesion as part of meaning construction. It also indicates that without scaffolded exposure to authentic texts and guided practice, learners are unlikely to develop the genre-sensitive awareness required to deploy cohesive devices in rhetorically appropriate ways, which is essential for effective communication and comprehension in various writing contexts.

4.7.2 Theme 2: Vocabulary as a Barrier

Students consistently identified limited vocabulary as a major challenge in producing cohesive writing, particularly in relation to lexical cohesion. During interviews, participants reported difficulty finding synonyms, hyponyms, or paraphrastic alternatives when attempting to avoid repetition. One student explained, “I want to say the same thing in a different way, but I only know one word for ‘clean’. So, I just keep saying ‘clean’ or ‘sanitation’.” This pattern was noted in several interviews, with students saying that their limited vocabulary often made them use the same word over and over in a paragraph. Several students said they knew they needed to use different words, but they didn’t have the language skills to do it well. Instructors corroborated these observations, noting that students frequently rely on familiar vocabulary items even when more precise or varied options are available. The interview data indicated that students often linked vocabulary development with memorization instead of active reading or exposure to various texts. This theme provides a descriptive account of how vocabulary constraints shape students’ ability to deploy lexical cohesion in their writing.

Students’ limited exposure to diverse academic texts compounded these challenges, reducing their opportunities to encounter natural patterns of lexical variation. Some participants described relying heavily on bilingual dictionaries, which often produced literal or context-inappropriate alternatives, further undermining cohesive expression and leading to fragmented sentences that lacked clarity. Instructors also noted that without explicit modeling of how writers build lexical chains across sentences, students struggled to see vocabulary as part of a broader meaning-making system rather than isolated word choices. Largely, the data suggest that vocabulary limitations restrict not only lexical variety but also students’ ability to construct semantically connected discourse. At a deeper level, this limitation shows that students have not fully developed their mental lexicon as a connected system, which makes it challenging for them to use and organize groups of words in context. Furthermore, the issue points to a

gap between receptive and productive vocabulary knowledge, in which students may recognize variation in input but lack the procedural control to deploy it strategically for cohesive and rhetorically effective writing. This disconnect suggests that lexical knowledge alone is insufficient for discourse development unless learners also acquire the metalinguistic awareness and automatized retrieval skills needed to mobilize vocabulary in real-time composition.

4.7.3 Theme 3: Cognitive Overload

Instructors highlighted the cognitive demands placed on students within the health science curriculum as a factor influencing their use of cohesive devices. They reported that students often prioritize memorizing medical facts, disease symptoms, and procedural information, which occupies a substantial portion of their working memory during writing tasks. As one instructor noted, students are “preoccupied with medical facts,” leaving limited cognitive capacity for managing cohesive chains or monitoring the clarity of referential links. This pattern was described across all instructor interviews, with several participants indicating that students frequently focus on content accuracy at the expense of linguistic organization. Teachers also observed that students tended to write under time pressure, further constraining their ability to attend to cohesion. The interview data indicated that students rarely participated in revision or rereading, thereby constraining opportunities to identify and rectify cohesion-related issues. This theme provides a descriptive account of how cognitive load associated with disciplinary content influences students’ management of cohesive structures in academic writing. Instructors further noted that the simultaneous demands of recalling technical terminology, structuring clinical explanations, and meeting assignment requirements often left students with little attentional bandwidth for monitoring cohesion.

Some teachers described this as a form of “disciplinary overload,” where the cognitive effort required to manage content knowledge eclipses students’ ability to track pronoun references, logical sequencing, or lexical variation. Some instructors also suggested that because cohesion is rarely assessed explicitly, students perceive it as secondary to demonstrating biomedical accuracy, reinforcing the tendency to overlook cohesive structuring. Mostly, the data indicate that cognitive load limits students’ real-time cohesion management and reduces their motivation to engage in revision practices that could strengthen cohesive control. From a cognitive perspective, the evidence suggests that cohesion is treated as a lower-priority, non-automated process that fails to become integrated into students’ procedural writing knowledge under conditions of high task complexity. Moreover, the findings point to an underdevelopment of metalinguistic awareness, where students lack the cognitive flexibility to shift between content generation and discourse-level monitoring, a skill essential for producing coherent academic texts in cognitively demanding disciplines.

5. Discussion

5.1 Synthesis of Quantitative and Qualitative Patterns

The study provided a comprehensive overview of students’ use of cohesive devices, focusing on the broader context of ESL rather than solely on individual measurements. It makes three important contributions to the field. It expands cohesion research into health-science education, a domain where discourse development is influenced by technical content requirements and has been predominantly neglected in previous ESL scholarship. It integrates cognitive load theory with discourse-analytic perspectives, offering a theoretically grounded explanation for how disciplinary content, working-memory constraints, and linguistic resources jointly influence students’ ability to produce cohesive and coherent texts. It also provides empirically supported pedagogical insights for discipline-specific writing instruction, generating evidence that can inform curriculum design, instructional practices, and targeted interventions aimed at strengthening academic and professional communication in health-science training environments.

Utilizing SPSS version 26, the quantitative analysis established clear distributional tendencies across the corpus, revealing that grammatical cohesion—particularly reference and conjunction—constituted most cohesive ties. These findings were grounded in rigorous descriptive statistics, including measures of central tendency and dispersion, which characterized the variability in cohesion usage and provided an empirical foundation for identifying prevailing patterns. To ensure the validity of these statistical outputs, diagnostic procedures involving Shapiro–Wilk tests and Q-Q plots were employed to assess the data's distributional properties, allowing for a robust transition from descriptive summaries to the functional relevance of the results. Subsequently numerical patterns were triangulated with qualitative data obtained from semi-structured interviews of both instructors and students. This mixed-methods design facilitated a multilayered presentation of the findings, in which the statistical frequency of cohesive devices was contextualized by the participants' detailed accounts of the instructional environment and cognitive conditions at BCHS. By aligning the quantitative strand with qualitative narratives, the study provides a structured overview of the current state of learner discourse. This synthesis validates the argument that linguistic performance in specialized health science contexts is a systemic product of both pedagogical history and the cognitive constraints inherent in discipline-specific academic writing (Douglas, 2025; Tabari & Johnson, 2023).

The first area of alignment identified in this study concerns the significant predominance of grammatical cohesion within the student scripts. Quantitatively, reference and conjunction devices accounted for 79.7% of all cohesive ties, with reference alone representing nearly half (48.2%) of all instances recorded. This high density suggests that students rely on the most explicit "anchors" of textuality described by Halliday and Hasan (2014) to maintain surface-level continuity. This numerical dominance was explicitly reflected in the qualitative teacher interviews, where instructors reported that cohesion instruction at BCHS is primarily delivered through "list-based" methodologies. These practices often involve providing students with sets of connectors and pronouns as isolated lexical items, rather than as functional tools for discourse. Such a pedagogical approach confirms Widdowson's (1978) long-standing critique that teaching language as a collection of formal items, rather than as a communicative system, results in a restricted and repetitive use of the target language. Students' accounts corroborated this assertion, admitting they utilized these specific markers because they were the ones most frequently emphasized in class. This convergence demonstrates a "pedagogical reflex"; the statistical dominance of reference and conjunctions is a direct byproduct of an instructional architecture that prioritizes formal grammatical accuracy over the nuanced, functional application of cohesive resources required for sophisticated academic prose (Widdowson, 1978; Tabari & Johnson, 2023).

A second area of convergence involved the relatively low frequency of lexical cohesion, which accounted for only 17.1% of all cohesive ties in the quantitative dataset. This pattern corresponded directly with student interview data, in which participants consistently identified limited vocabulary as the primary barrier to their writing performance. Students reported significant difficulty in finding synonyms or alternative expressions to maintain thematic flow, often resulting in the verbatim repetition of the same lexical items throughout a paragraph. This qualitative reporting provides the "why" behind the low statistical frequency of reiteration and collocation. In this context, the lexical patterns observed reflect what Cervetti and Wright (2020) term the "knowledge effect"—the phenomenon where linguistic performance is inextricably linked to the depth of the student's underlying disciplinary vocabulary. While Medve and Takač (2013) suggest that cohesion density does not always predict text quality in general ESL settings, the strong correlation ($r = 0.685$) found in this study between lexical variety and coherence indicates that in health science writing, lexical diversity is a structural necessity. Unlike the undergraduate abstracts studied by Suwandi (2016), which require high-density linguistic economy, the extended essays at BCHS expose the students' lexical limitations. The relationship between the low quantitative frequency and the qualitative reports of vocabulary struggle provides a coherent account of how a lack of domain-specific lexical resources hinders the construction of the complex semantic chains essential for health science discourse (Cervetti et al., 2016; Douglas, 2025).

A third critical point of configuration emerged regarding the cognitive demands inherent to the health science writing context. While the quantitative data showed that substitution and ellipsis—devices requiring the highest levels of structural monitoring—represented a mere 3.2% of all cohesive ties, the qualitative interviews offered a detailed description of the mental constraints causing this rarity. Following Sweller et al. (2019), the cognitive architecture of these ESL learners appears to be suffering from "disciplinary overload." Teachers observed that students were often too preoccupied with the accuracy of medical facts and technical terminology to dedicate sufficient cognitive "bandwidth" to the linguistic management of their essays. Students confirmed these findings, stating that their primary focus on content accuracy resulted in a neglect of cohesive structures. This descriptive evidence aligns with Cook and O'Brien's (2015) work on inference generation, which suggests that when a writer's cognitive resources are diverted to factual recall, they fail to provide the sophisticated cohesive cues that ease the reader's processing burden. The infrequent occurrence of substitution and ellipsis serves as a quantitative indicator of a cognitive trade-off; students forfeit linguistic sophistication to preserve factual accuracy. This integrated presentation provides a comprehensive analysis of how content-related demands shape the distribution of cohesive forms, reinforcing the need for pedagogical interventions that integrate vocabulary development with cognitive load management in specialized academic writing (Sweller et al., 2019; Smith et al., 2021).

5.2 Thematic Interpretation of Cohesion Patterns

The findings of this study indicate that students at the BCHS predominantly utilize fundamental cohesive devices, with a heavy reliance on grammatical reference (48.2%) and basic conjunctions (31.5%). This distributional profile corresponds with the findings of Tabari and Johnson (2023) concerning ESL learners' inclination for explicit linking markers in academic discourse. However, the strikingly minimal application of sophisticated strategies, such as ellipsis and substitution, signals a significant departure from the "advanced academic" cohesive repertoire described by Halliday and Hasan (2014). From this perspective, this restricted range is not merely a linguistic deficit but a direct consequence of specific disciplinary demands inherent to health science education. In clinical and medical writing, the primary objective is the elimination of ambiguity. While Suwandi's (2016) analysis of undergraduate abstracts showed higher frequencies of ellipsis to meet word-count constraints, the extended expository essays produced by BCHS students require the explicit tracking of complex technical concepts, symptoms, and pharmacological interventions. In this context, the high frequency of anaphoric reference acts as a safety mechanism; students prioritize the clear re-identification of "the patient," "the condition," or "the treatment" over the more sophisticated but potentially ambiguous linguistic economy of ellipsis. Consequently, the data suggests that the genre-specific requirement for factual precision in health sciences may inadvertently discourage the use of varied cohesive devices, leading students to adopt a "clarity-first" strategy that favors repetition and basic grammatical links.

A significant finding of this research is the robust positive correlation ($r = 0.68$) between lexical variety and overall coherence scores. While broader meta-analyses in general academic writing, such as those by Medve and Takač (2013), often suggest that cohesive density does not consistently predict writing quality, the BCHS context provides a compelling validation of the "knowledge effect" (Cervetti & Wright, 2020). In specialized health science discourse, the writer's mastery of disciplinary lexical chains inextricably links to conceptual coherence. This study corroborates the theoretical assertions of McNamara et al. (2011) and Douglas (2025), who contend that domain-specific expository texts impose significantly greater processing demands on the writer's linguistic resources. The data demonstrates that students possessing a broader health-related vocabulary were uniquely equipped to sustain the complex semantic networks required to explain pathological processes or clinical procedures. Additionally, this study utilizes meticulous manual coding instead of the automated cohesion indices preferred in numerous contemporary studies (e.g., Douglas, 2025), providing a more subtle and detailed validation that lexical cohesion is not simply a stylistic enhancement. Instead, in health science training, lexical diversity serves as a structural necessity. It allows the writer to maintain "conceptual thread" across a text, proving that

linguistic performance is heavily dependent on the depth of the student's underlying disciplinary knowledge. Without the requisite technical vocabulary, students cannot achieve high-level coherence, regardless of their familiarity with basic transitional markers.

The quantitative rarity of structurally demanding devices like substitution and ellipsis—collectively accounting for only 3.2% of cohesive ties—reveals a critical conflict between content processing and linguistic execution. Drawing upon the work of Sweller et al. (2019), it is evident that the extreme cognitive load associated with recalling intricate medical facts and terminology creates a "bottleneck" that diminishes the mental resources available for sophisticated linguistic decision-making. Interviews with BCHS instructors confirmed that students are frequently "preoccupied" with the accuracy of medical facts, leaving insufficient cognitive bandwidth for managing the complex structural monitoring required for advanced cohesion. This struggle is significantly exacerbated by the current instructional architecture at the college, which mirrors Widdowson's (1978) seminal critique of teaching cohesion as a list of isolated, rote-learned markers rather than functional tools of discourse, leading to students' difficulties in effectively utilizing cohesive devices in their writing. The findings reinforce the necessity of the reading–writing connection (Castles et al., 2018; Smith et al., 2021) as a pedagogical solution. Students who participated in extensive reading of medical literature exhibited superior lexical cohesion, corroborating the view that vocabulary depth and inference-making are mutually reinforcing (Elleman, 2017; Saimon et al., 2023). By contextualizing these patterns, this study distinguishes itself from prior research (Adem & Berkessa, 2022) by providing triangulated evidence that specialized academic writing requires a fundamental pedagogical shift. Educators must move beyond the "list-based" teaching of connectors and toward an integrated approach that manages cognitive load through genre-based modeling and the functional application of cohesive devices within authentic health science contexts. These findings indicate the necessity for institutional reforms in language instruction within health science education, encompassing curriculum integration, teacher training, and the alignment of language and content instruction.

6. Conclusion

The purpose of this study was to examine the use of cohesive and coherent devices in the academic writing of first-year students at Bibiani College of Health Sciences. The findings demonstrate that while students possess a foundational command of grammatical cohesion—particularly reference and conjunctions—their writing exhibits limited lexical cohesion, a restricted vocabulary range, and frequent mechanical repetition. The confirmed correlation between lexical variety and coherence underscores the central role of vocabulary depth in producing well-structured expository texts. The qualitative evidence further revealed that instructional practices at BCHS rely heavily on lists of transition markers, with limited emphasis on semantic nuance or functional deployment. Students' descriptions of vocabulary constraints and cognitive overload provide additional context for the patterns observed in the scripts. These findings indicate that the coherence challenges identified in the essays are not isolated errors but reflect broader linguistic, instructional, and cognitive conditions within the learning environment.

The implications of these findings extend to curriculum design, pedagogical practice, and disciplinary literacy development in health science education. The dominance of grammatical cohesion and the underuse of lexical devices suggest that current instructional approaches do not sufficiently support students in developing the linguistic flexibility required for academic and professional communication. Given the genre-specific demands of health science writing—where precision, clarity, and terminological variation are essential—the limited lexical range observed in the scripts may hinder students' ability to produce coherent reports, case summaries, and clinical narratives. The qualitative data also highlight the influence of cognitive load, as students' focus on mastering medical content appears to reduce the cognitive resources available for managing cohesive structures. These implications underscore the necessity for integrated literacy instruction that encompasses both linguistic proficiency and disciplinary knowledge, thereby enabling students to express intricate health concepts with clarity and coherence.

However, the single-institution context and cross-sectional design limit the findings, making it difficult to determine how these results might apply to other educational contexts or over time. These constraints may restrict the generalizability of the results to broader educational settings and more diverse student populations. This includes learners in different geographical regions or under varying educational systems. Therefore, further research involving multiple institutions and longitudinal designs is necessary to comprehend these dynamics across a broader range of contexts.

Based on the findings, three recommendations are proposed to strengthen cohesion and coherence in student writing. First, explicit lexical instruction should be incorporated into the communication skills curriculum, emphasizing collocations, synonyms, and lexical bundles relevant to the health sciences. This aligns with lexical approach principles and supports the development of domain-specific vocabulary. Second, genre-based pedagogy should be adopted, using authentic health science texts—such as case reports, patient education materials, and public health briefs—to model cohesive structures in context. This method lets students see how cohesive devices work in real-life academic genres. Third, structured peer review activities should be implemented, focusing on identifying ambiguous references, improving logical flow, and strengthening lexical variety. Peer review encourages metalinguistic awareness and provides opportunities for students to evaluate cohesion in their own and others' writing. These suggestions provide a useful way to help students strengthen their academic writing skills and become better health science communicators in general. Ultimately, improving cohesion and coherence in student writing is not simply a matter of linguistic correction but requires a systemic rethinking of how language, cognition, and disciplinary knowledge are integrated within higher education.

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