Intellectual pathways to academic writing in ELT: Mapping cognitive skills interactions in multilingual learners

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Abstract

Cognition plays a critical role in literacy development and is widely recognized as a foundational factor in acquiring skills for learning a target language. In English language teaching, writing proficiency is often considered a key indicator of overall language competence. Consequently, identifying variables that significantly predict writing skills is essential for enhancing pedagogical strategies and student outcomes. This study employed path analysis to examine the direct causal effects of English proficiency, reading comprehension, science process skills, quantitative skills, and abstract thinking skills on key dimensions of writing: lexical resource, grammatical range and accuracy, coherence and cohesion, and task achievement. Data were collected from 188 first year multiligual college students through aptitude tests and writing assessments and analyzed using linear regression.

Results indicated that English proficiency significantly predicted lexical resource ($R = .276$, p .001), grammatical range and accuracy ($R = .327$, $p < .001$), coherence and cohesion ($R = .309$, $p < .001$), and task achievement ($R = .327$, $p < .001$). Science process skills were found to be significant predictors of grammatical range and accuracy ($R = .194$, $p = .007$), coherence and cohesion ($R = .185$, $p = .011$), and task achievement ($R = .212$, $p = .004$). Abstract thinking skills also significantly predicted lexical resource ($R = .151$, $p = .039$), grammatical range and accuracy ($R = .158$, $p = .030$), coherence and cohesion ($R = .150$, $p = .040$), and task achievement ($R = .191$, $p = .009$). These findings suggest that prioritizing English proficiency, science process skills, and abstract thinking skills in the multiligual classroom is crucial for enhancing students' writing competence.

Keywords

Cognitive skills, writing skills, path analysis, ELT, multilingual

1 Introduction

Learning English language is a process of learning several skills. One must be productively and receptively skilled to be able to use English effectively. Concluding these skills in the hierarchy is the writing skill (Gepila, 2017). In learning a second language, we listen first, then speak, read and lastly write; this is commonly known as the LSRW hierarchy. This hierarchy

of skills has spark arguments among linguists. But over the years, writing is considered as the most difficult and highest form among the four skills (Catabay, 2016; Gepila, 2017; Gustilo, 2016; Pablo & Lasaten, 2018; Suhito, Waluyo & Setiawan, 2018; Zhang, 2013). In fact, in a study conducted by Mohammadi and Zarrabi (2022), EFL learners homogenously agreed that writing is a difficult skill to learn. Akin to this finding is the research carried out by Purwanti and Kastuhandani (2023) on the challenges of writing articles among English Language Education Study Program (ELESP) students. It was disclosed that majority of respondents have faced several difficulty. In conformity, Nickerson, Perkins, and Smith (2014) remarked that successful learning of second language is exhibited by how proficient a learner is in terms of writing. Therefore, it can be inferred that once learners are proficient in writing, they are generally considered as language proficient. Thus, teachers and researchers posited various frameworks on the development of writing skill in language teaching and learning. Teachers who are exposed to profuse models of teaching English deemed these frameworks to maximize writing performance. Oftentimes, they agree without protest and recognize each framework deftly presented as true and acceptable to their respective learning setting. Few repudiated these models, scrutinized interrelations that exist in the unique context of the learners and test the effects of these factors deemed to develop writing skills. It is important to note that though these factors and models warrant evidence, it is vital to explicate these concepts. Depending on the context, these factors can be repressive or expansive. One example is the assumption that students who performed well are generally good in writing. However, Sidupa and Rahyono (2019) found out that learners who are in the intermediate level utilized advanced words than students in the upper-intermediate level. Moreover, the complex and difficult process of writing is highlighted in several studies. In one of the many studies, it was discovered that students displayed poor, weak, or fair range in the quality and mechanical aspects in their outputs, manifested no confidence in writing tasks, and exhibited weakness in grammar and limited vocabulary (Paurillo, 2019). As the situation warrants, the prevalent difficulty in teaching and learning writing necessitates research-based action to deal with the problem at hand.

One of the models ubiquitous among language teachers is contributed by Gardner (1985). He presented "individual differences" as one of the components in his Socio-educational Model. Individual differences include cognitive constructs as drivers of language learning. In agreement, Kellogg (2001) opined that writing is a cognitive process. It is a test of memory, an ability to think and a skill to command verbally that allows the learner to express ideas yet many studies centered on writing but few studies have examined other skills (Ueno, et al.2025). Language learning and teaching with writing as an inseparable part is generally influenced by cognitive factors. Sheer magnitude of literature on this construct is exhibited: thus, regarded as fundamental aspects of many studies. Laying the groundwork from this major construct, this study is aimed to determine the significance and magnitude of hypothesized causal connections among cognitive constructs namely: English proficiency, reading comprehension, science process skills, quantitative skills, and abstract thinking skills to lexical resource, grammatical range and accuracy, coherence and cohesion and task achievement writing skills. Specifically this study is aimed to seek answer to the research question:

1. Which cognitive constructs can directly and significantly predict the respondents' level of writing skills in terms of:

a. lexical resource;
b. grammatical range and accuracy;
c. coherence and cohesion; and
d. task achievement?

Albeit plethora of research proliferated to enforce, enrich, and improve writing skills, it is notable that majority of these studies focused only on determining the students 'level on writing proficiency and correlate variables deemed to affect language learning and writing skills. Concurring to this, Graham, Gillespie and McKeown (2013) stated that though extant theoretical models of writing are widely available, researchers have still so much to dig. To fill this gap, with utmost consideration that cognitive construct is deemed to be a marker of success in terms of writing skills development, this research is carried out to determine which of the hypothesized cognitive variables can directly significantly predict the respondents' level of writing skills.

1.1 Writing

Writing is a complex skill. To be proficient in writing, one must learn and acquire several micro-skills that work cohesively with one another to produce an acceptable written text. One of the most acknowledged micro-skills in writing recognized internationally are specified by the International English Language Testing System and Brown (2007). Firstly, lexical resource applies to the ability of the learner to express correctly and appropriately using his/her vocabulary, produce graphemes and orthographic patterns, generate an adequate core of words, used accurate word order patters, recognized between literal and implied meaning, and convey cultural specific reference correctly. Secondly, grammatical range and accuracy, refers to the learners 'knowledge to apply precise grammatical rules in sentence structures including using acceptable grammatical systems, patterns, and rules. This also covers expressing a specific meaning in various grammatical forms. Thirdly, cohesion and coherence appertain to the flow and organization of ideas by using cohesive devices and conveying transitions and connections. Finally, task achievement is a dimension that assessed the overall completion of the given writing task and full development of the essay, producing composition at an efficient rate of speed that is well-suited to the objective of the writing task, utilizing writing strategies and accomplishing the communicative functions of the written text.

1.2 Cognitive Constructs

English Proficiency

Aptitude as a predictor variable is supported by Munoz (2014). A study was carried out comparing the connection between the aptitude results of students to the four basic skills-

speaking, reading, listening, and writing. It was concluded that aptitude test scores possess predictive value to writing, reading, and listening skills. Further, Racca and Lasaten (2016) probed the association between English proficiency and academic performance on the subjects Science, Math, and English among students. It was found out that there was a significant relationship between English proficiency and academic performance in English. The association implies that students' English proficiency is also associated to writing skills. Further, in a study conducted by Olaivar (2012), a strong significant relationship was revealed between English proficiency and academic performance including English as a subject.

1.3 Reading Comprehension

Graham (2018) cited in Pierce (2018) boldly claimed that reading and writing are entwined forever. This close link helps develop the other. However, this is not a new concept for most researchers. There have been studies in agreement to the significance of reading and writing and their connection (Berninger, Cartwright, Yates, Swanson, & Abbott, 1994; Berninger Abbott, Abbott, Graham & Richards, 2002; Shanahan, 2009; Shen, 2009; Abbott, Berninger & Fayol, 2010; Llach, 2010; Chapelle, Enright, & Jamieson, 2011; Peha, 2016; Fink , 2017). Even in the field of utilizing computer assisted test, reading comprehension correlates with writing skills. In a study conducted by Suhita, Waluyo and Setiawan (2018) using reading comprehension skill, vocabulary mastery and attitude toward language as correlating variables to writing, the findings showed a positive correlation between the variables and writing skills. Among the three, reading comprehension has the highest contribution of 44.75% to writing skills. Similarly, Motlaq and Egresh (2016) researched on the relationship between reading ability and writing quality among EFL Iranian academic writers. The result warrants a significant relationship. They also highlighted that this correlation is evident in the syntactic structure in writing among the EFL academic writers but not in organizational structure. In addition, Cho (2015) conducted a correlational study between reading and reading-to-write ability among Korean L2 learners. It revealed a high correlated relationship result. Thus, he concluded that to successfully perform reading-to-write tasks, it necessitates reading ability. Moreover, Ershadi, Syarfi and Sumbayak (2012) also put forward their agreement on the notion that reading, and writing are connected. In their study among students of English study program, they found out that a moderate correlation between reading comprehension and writing narrative text ability exists. In a more detailed study by Allen, Snow, Crossley, Jackson, and McNamara(2014), reading comprehension components were hypothesized to correlate with writing. The result suggested that reading comprehension and writing accessed both knowledge sources and higher- level cognitive skills. Although the strong relationship between reading comprehension is established by many studies, few contradict such claim. Juriati, Ariyanti and Fitriana (2018) have disclosed a low correlation of 0.189 coefficient correlation between these variables, reading comprehension and writing ability in descriptive text to be specific. For many years, reading and writing are taught separately (Nelson & Calfee, 1998). But Berninger (2000) contested this approach and advocated that the four skills in language learning should be taught in parallel to one another.

1.4 Science Process Skills

Studies on the association between science process skills and writing skills are scarce. Considering the predictive value of science process skills towards writing is based on Tomera's (1974) research on transfer ability of science process knowledge. It is claimed that science process skills that are learned and retained can be transferred and utilized to other diverse situations. There are several science basic process skills. Curriculum Development Centre (1993) cited in Punia, Jizah, Adzliana and Kamisah (2012) classified the fundamental science process skills as (1) the ability to observe, (2) classify, (3) measure, (4) infer, (5) predict, (6) communicate, and (7) use numbers and relations of space and time. Furthermore, it is also characterized by the ability to interpret, experiment, operationalized definition, manage and control variables and create hypothesis. Thus, it can be inferred that through transfer ability these science process skills can be tapped when students are engaged in writing task. Another cognitive construct as predictor variable employed in this research is the quantitative and mathematical ability of the students.

1.5 Quantitative Skills

Though studies exploring the relationship between mathematical ability towards writing skills are not abundant, there are some few to support the connection between the two. One of which is the study conducted by Dundar (2016). In this study, writing skill was attributed to the students 'note by examining the contents of their notebooks. It was determined that students who have achieved success in mathematics have a remarkable content in their notebooks compared to those who are less successful in mathematics. Abstract skills pertain to the ability of an individual to analyze information, detect pattern and relation, and solve problems on complex level (Datta & Roy, 2015).

1.6 Abstract Thinking Skills

Abstract skills are closely related to learners 'academic achievement (Kusmaryon, Suyitno, Dwijanto, & Dwidayati, 2018). Darwish (2014) also emphasized that individual's learning and understanding depends on his/her ability to cognitively process and to think abstractly. Again, academic achievement is perceived to encompass language learning; hence, it also covers writing skills.

2 Methodology

Owing to their diversity in interests, academic disciplines, personalities, cognitive abilities, and socio-cultural and lingusitic backgrounds backgrounds, first year multilingual college students were chosen as respondents. These students took the University Aptitude Test, which assesses five key areas: English Proficiency, Reading Comprehension, Science Process Skills,

Quantitative Skills, and Abstract Thinking Skills. The data for the predictor variables were drawn from the results of this standardized test administered by the university.

To obtain data for analysis of writing skills, a writing test was conducted. The design of the writing task was grounded in the concept of schema theory, which has been widely explored in studies on writing processes (Sun, 2014). Schema theory posits that each individual possesses a network of prior knowledge related to specific concepts, and effective writing requires the activation of these existing schemata in conjunction with new information stored in long-term memory. Moran and Billen (2014) further emphasize the importance of authentic literacy experiences that are directly and meaningfully relevant to students' lives, arguing that literacy instruction is most effective when it reflects real-world contexts.

In line with this principle, the present study employed a writing prompt based on academic experiences to facilitate the complex process of writing. This approach aimed to minimize the possibility that respondents' inability to relate to an unfamiliar topic would hinder their written expression. When students write about topics disconnected from their academic experiences, the task may inadvertently measure their background knowledge rather than their actual writing ability. Conversely, experience-based prompts allow respondents to access their prior knowledge and express ideas freely, irrespective of differences in background or discipline. Such prompts encourage the activation of personal schemata, enabling learners to organize and scaffold their essays based on both prior and newly acquired knowledge.

To ensure content validity, the writing prompt was reviewed and validated by three experts in language teaching. It was intentionally designed to stimulate idea generation and personal engagement, allowing respondents to draw from their experiences and stored knowledge to initiate the writing process. As Smith and Swain (2011) noted, personal experiences serve as a powerful motivational factor for novice writers, encouraging them to express their thoughts with confidence, authenticity, and a sense of ownership.

The study employed linear regression analysis to determine which cognitive variables significantly and directly—or indirectly—predicted the respondents' levels of writing proficiency. The university's passing percentile rate of 60.00 served as the benchmark for interpreting the Aptitude Test results; scores below 59.99 were classified as below average. Score intervals were computed based on the passing percentile rate (60.00) up to the highest attainable score (99.99).

Furthermore, three English language teachers evaluated the respondents' written outputs across the four dimensions of writing skills: lexical resource, grammatical range and accuracy, coherence and cohesion, and task achievement. The rating scales used for both the Aptitude Test and the Writing Task are presented below:

English Proficiency, Reading Comprehension, Science Process Skills, Quantitative Skills, and Abstract Skills Aptitude Rating Scale

Percentile Rank		Descriptive Rating
86.67	-99.99	High
73.34	-86.66	Above Average
60.00	-73.33	Average
59.99	-below	Below Average

Writing Task Rating Scale

Score	Descriptive Rating
4.21 -5.00	Excellent
3.41 -4.20	Very good
2.61 -3.40	Good
1.81 -2.60	Below Average
1.0 -1.80	Needs Improvement

3 Results and Discussion

Table 1.0 shows the details of the Linear Regression Model Summary of the students English proficiency as predictor to their lexical resource, grammatical range and accuracy, coherence and cohesion and task achievement. It can be gathered that English proficiency can significantly predict students writing skills on lexical resource, grammatical range and accuracy, coherence and cohesion, and task achievement with an F ratio of 15.336, 22.227, 19.634, and 22.316 and corresponding probability values of .000 significant at alpha=0.05.

Table 1.0

Path 1: Linear Regression Model Summary Table: Respondents' English Proficiency as Predictor to their Lexical Resource, Grammatical Range and Accuracy, Coherence and Cohesion and Task Achievement

Variables	R	R Square	F	P
English Proficiency and Lexical Resource	.276	.076	15.336	.000*
English Proficiency and Grammatical Range and Accuracy	.327	.107	22.227	.000*
English Proficiency and Coherence and Cohesion	.309	.095	19.634	.000*
English Proficiency and task Achievement	.327	.107	22.316	.000*

(*Significant at Alpha=0.05)

Table 1.1 indicates the Beta Coefficient of the respondents English proficiency as predictor to their Lexical resource, grammatical range and accuracy, coherence and cohesion and task achievement. Further probing suggests that English proficiency can significantly predict 7.61 percent or $(.276)_2$ on lexical resource, 10.69 percent or $(.327)_2$ on grammatical range and accuracy, 9.54 percent or $(.309)_2$ on coherence and cohesion, and 13.83 percent or $(.327)_2$ on task achievement.

Table 1.1

Beta Coefficient's Table: Respondents' English Proficiency as Predictor to their Lexical Resource, Grammatical Range and Accuracy, Coherence and Cohesion and Task Achievement

Variables	Standardized Beta Coefficient	T	Sig
English Proficiency and Lexical Resource	.276	3.916	.000*
English Proficiency and Grammatical Accuracy	.327	4.715	.000*
English Proficiency and Coherence and Cohesion	.309	4.431	.000*
English Proficiency and Task Achievement	.327	4.724	.000*

(*Significant at Alpha=0.05)

The predictive value of English proficiency is initially established by the correlation of English Proficiency and academic performance which encompasses writing skills as put forward by Olaivar (2012). Writing skills and proficiency of the language used in writing are two aspects that are inseparable. A correlation that is strengthened by various studies. Racca and Lasaten (2016) postulated that one cannot communicate through written text without the needed language aptitude. This predictive value of English proficiency to writing skills also concords with the study of Munoz (2014). This suggests that it entails English proficiency in order for students to create an acceptable written output characterized by a certain degree of lexicality, conformity to grammatical systems, patterns, and rules of the English language, use of cohesive devices and strategies in various rhetorical forms and conventions and consideration of culturally specific references.

Albeit substantial research were carried out relative to the connection between reading and writing, e.g Suhita, Waluyo and Setiawan(2018), Motlaq and Egresh (2016), Cho (2015) and Ershadi, Syarfi and Sumbayak (2012), the relationship between these two variables in this study does not warrant a predictive value to students' lexical resource, grammatical range and accuracy, cohesion and coherence and task achievement as refelcted in Table 2.0. This result is in agreement with the study of Juriati, Ariyanti and Fitriana (2018) which contradicts the connection between reading and writing.

Table 2.0

Path 2: Linear Regression Model Summary Table: First Year College Students 'Reading Comprehension Aptitude as Predictor to their Lexical Resource, Grammatical Range and Accuracy, Coherence and Cohesion and Task Achievement

Variables	R	R Square	F	P
Reading Comprehension and Lexical Resource	.096	.009	1.718	.192
Reading Comprehension and Grammatical Range and Accuracy	.128	.016	3.097	.080
Reading Comprehension and Cohesion and Coherence	.067	.005	.842	.360
2.4 Reading Comprehension and Task Achievement	.136	.018	3.487	.063

Table 3.0 and 3.1 show the Science Process Skills can significantly predict students grammatical range (F=7.310; P =.007), cohesion and coherence (F=6.603; P=.011) and task achievement (F=8.712: P=.004). With a T value of 2.704, 2.570 and 2.952 with corresponding probability values of .007,.011 and .004, Science process skills can predict 3.76 percent or $(.194)_2$, 3.42 percent or $(.185)_2$, and 4.49 percent or $(.212)_2$ of the students' Grammatical Range and Accuracy, coherence and cohesion, and task achievement, respectively.

Tomera (1974) put forward the concept of transfer ability. The predictive value of Science process skills to writing is attributed to transfer ability where skills learned in science can be channeled to various situations such as writing. Writing and science process skills both involved the basic concepts such as the ability to infer, communicate, classify and observe. Curriculum Development Centre (1993) cited in Punia, Jizah, Adzliana and Kamisah (2012) identifies the different types of Science process skills. Among these Science process skills are the abilities to make classification and communicate. These skills that students possessed are inferred to be helpful in terms of their skill in the grammatical aspect of learning English. In learning the grammatical structure of a language requires adeptness in terms of classifying the different parts of speech and how each word functions differently depending on the meaning it implies in the sentence. In can be inferred that students' task achievement are attributed to their abilities to measure, infer, predict and communicate. These skills allow the learners to estimate the efficiency of their rate of speed in writing, to strategize and to foresee outcomes in order to successfully accomplish a writing task.

Table 3.0

Path 3: *Linear Regression Model Summary Table: First Year College Students 'Science Process Skills Aptitude as Predictor to their Lexical Resource, Grammatical Range and Accuracy, Coherence and Cohesion and Task Achievement*

Variables	R	R Square	F	P
3.1 Science Process Skills and Lexical Resource	.065	.004	.801	.372
3.2 Science Process Skills and Grammatical Range and Accuracy	.194	.038	7.310	.007*
3.3 Science Process Skills and Coherence and Cohesion	.185	.034	6.603	.011*
3.4 Science Process Skills and Task Achievement	.212	.045	8.712	.004*

(*Significant at Alpha=0.05)

Table 3.1

Beta Coefficient's Table: First Year College Students 'Science Process Skills Aptitude as Predictor to their Grammatical Range and Accuracy, Coherence and Cohesion and Task Achievement

Variable	Standardized Beta Coefficient	T	Sig
3.1 Science Process Skills and Grammatical Range & Accuracy	.194	2.704	.007*
3.2 Science Process Skills and Coherence and Cohesion	.185	2.570	.011*
3.3 Science Process Skills and Task Achievement	.212	2.952 .	004*

(*Significant at Alpha=0.05)

Table 4.0 shows the Linear Regression Model Summary of the students' Quantitative Aptitude as predictor to their lexical resource, grammatical range and accuracy, coherence and cohesion and task achievement. The F values of .594,.229,.855,.929, and .135 with the corresponding value probability values of .442, .585, .356, .336, and .714 are not significant at alpha= 0.05. This signifies that Quantitative ability is not a significant predictor to the students

lexical resource, grammatical range and accuracy, coherence and cohesion and task achievement.

Table 4.0

Path 4
Linear Regression Model Summary Table: First Year College Students' Quantitative Skills Aptitude as predictor to their Lexical Resource, Grammatical Range and Accuracy, Coherence and Cohesion and Task Achievement

Variables	R	R Square	F	P
4.1 Quantitative Skills Aptitude And Lexical Resource	.040	.002	.299	.585
4.2 Quantitative Skills Aptitude and Grammatical Range And Accuracy	.068	.005	.855	.356
4.3 Quantitative Skills Aptitude and Coherence and Cohesion	.071	.005	.929	.336
4.4 Quantitative Skills Aptitude and Task Achievement	.027	.001	.135	.714

Reflected in Table 5.0 are the F values - 4.342, 4.779, 4.296 and 7.066 with corresponding probability values .039, .030, .040 and .009 respectively- of abstract skills as predictor to their lexical resource, grammatical range and accuracy, coherence and cohesion and task achievement which are significant at Alpha=0.05. Further, Table 5.1 suggests that abstract thinking skills can significantly predict 2.28 percent or $(.151)_2$ on lexical resource, 2.49 percent or $(.158)_2$ on grammatical range and accuracy, 2.25 percent or $(.150)_2$ on coherence and cohesion, and 3.64 percent or $(.191)_2$ on task achievement.

Kusmaryon, Suyitno, Dwijanto and Dwidayati (2018) highlighted the correlation between abstract thinking skills and academic achievement. Since writing is an academic and complex task, abstract thinking skills or the ability to analyze information and detect patterns and connection are important. Further, Darwish (2014) posited that learning is dependent on one's abstract ability. For example, grammatical range and accuracy involves the ability to express ideas using words that are very specific and accurate. When one has the skill to analyze information, it can be inferred that he/she gives attention to the minute details of a task which is a vital skill in developing grammatical skills. The predictive value of abstract thinking skills can be connected to the principle that to be good in abstraction is to possess the ability of analyzing and detecting patterns and relations (Datta & Roy, 2015). Synonymously, coherence and cohesion involve making connections and creating smooth transition of ideas. This predictive value of abstract thinking skills to coherence and cohesion supports Darwish (2014) study emphasizing that learning is dependent on abstract thinking skills. Finally, task

achievement involves the ability of the learner come up with an acceptable written output considering elements such time, conventions, rhetoric, functions and strategy (Brown, 2007). Thus, task achievement in writing can be very challenging for second language learners. However, this difficulty can be managed with the ability to solve complex problem which is attributed to abstract thinking ability.

Table 5.0

Path 5
Linear Regression Model Summary Table: First Year College Students' Abstract Skills Aptitude as Predictor to their Lexical Resource, Grammatical Range and Accuracy, Coherence and Cohesion and Task Achievement

Variables	R	R Square	F	P
5.1 Abstract Skills Aptitude and Lexical Resource	.151	.023	4.342	.039*
5.2 Abstract Skills Aptitude and Grammatical Range and Accuracy	.158	.025	4.779	.030*
5.3 Abstract Skills Aptitude and Coherence and Cohesion	.150	.023	4.296	.040*
5.4 Abstract Skills Aptitude and Task Achievement	.191	.037	7.066	.009*

(*Significant at Alpha=0.05)

Table 5.1

Beta Coefficient's Table: First Year College Students' Abstract Skills Aptitude as Predictor to their Lexical Resource, Grammatical Range and Accuracy, Coherence and Cohesion and Task Achievement

Variables	Standardized Beta Coefficient	T	Sig
5.1 Abstract Skills Aptitude and Lexical Resource	.151	2.084	.039*
5.2 Abstract Skills Aptitude and Grammatical Range and Accuracy	.158	2.186	.030*
5.3 Abstract Skills Aptitude and Coherence and Cohesion	.150	2.073	.040*
5.4 Abstract Skills Aptitude and Task Achievement	.191	2.658	.009*

(*Significant at Alpha=0.05)

Thus, the following output models are proposed as the outcome of this research:

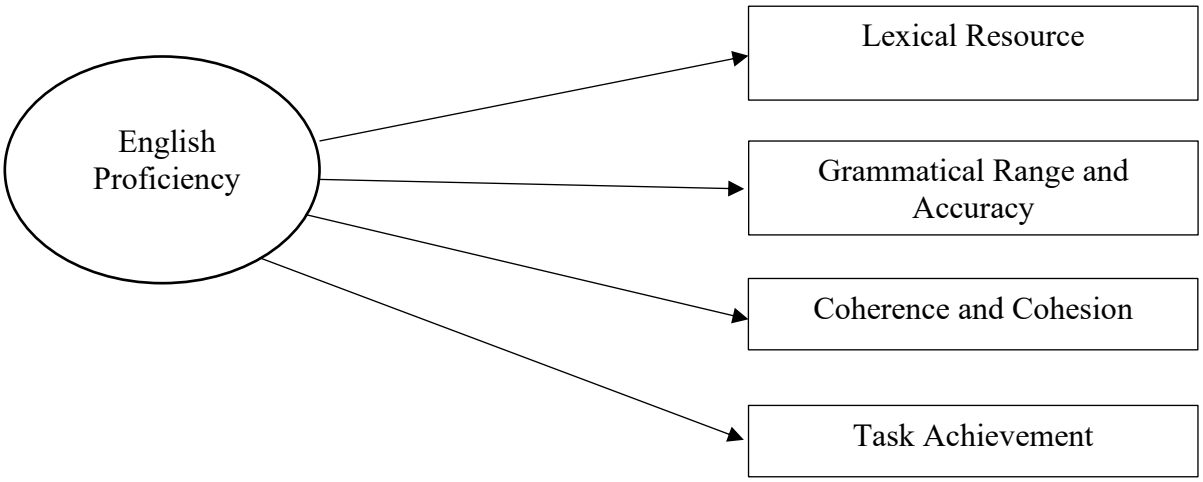

Figure 1

Output Model 1: English Proficiency as Predictor to Lexical Resource, Grammatical Range and Accuracy, Coherence and Cohesion and Task Achievement

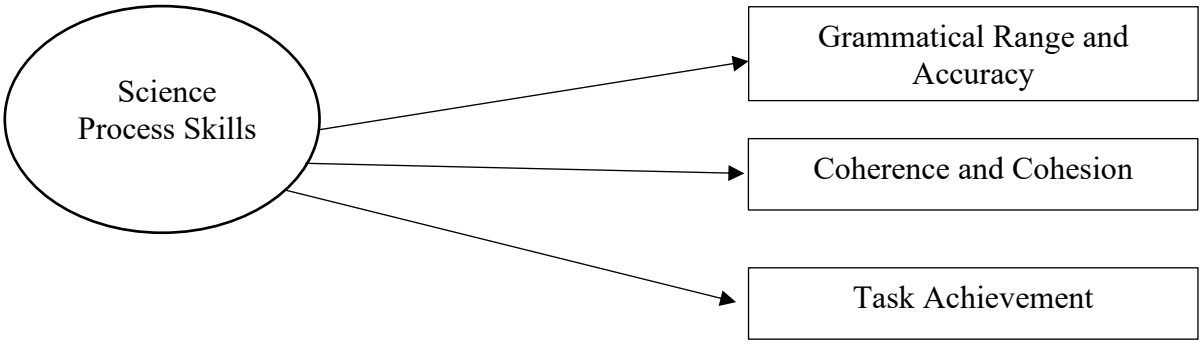

Figure 2

Output Model 2: Science Process Skills as Predictor to Lexical Resource, Grammatical Range and Accuracy, Coherence and Cohesion and Task Achievement

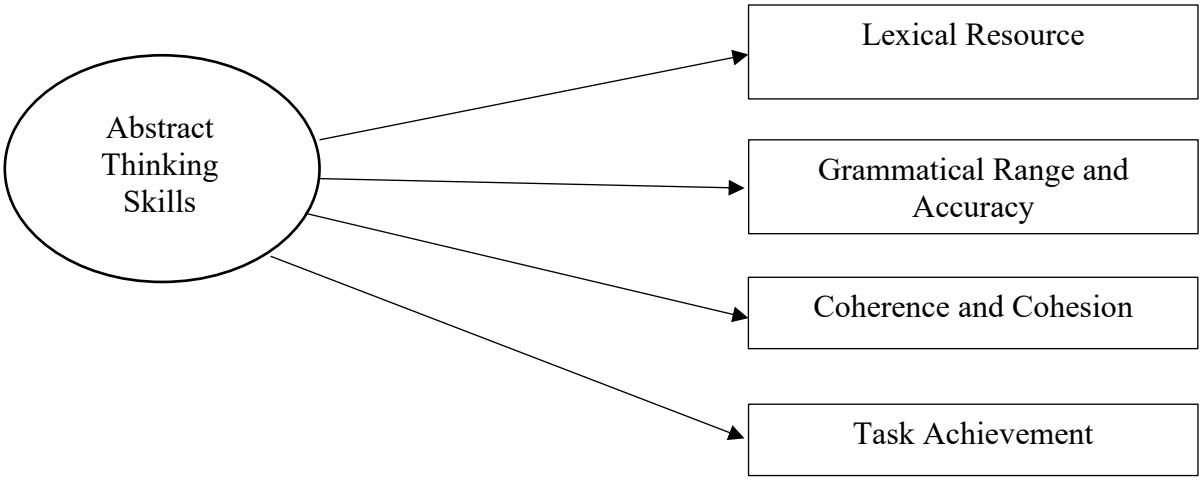

Figure 3

Output Model 3: abstract Thinking Skills as Predictor to Lexical Resource, Grammatical Range and Accuracy, Coherence and Cohesion and Task Achievement

Based on the findings, teachers may consider the output models when targeting a particular writing skill to develop among learners. Given that English proficiency warrants a significant predictive value to writing skills and its four dimensions it is recommended that writing class should include initial activities that strengthen this aspect rather than proceeding to writing activity right away. To improve writing skills, students must also improve their English language acumen. The most basic ingredient for students to accurately express ideas is their proficiency in English. This should be given emphasis in all English multilingual classes. On the aspect of Science process skills and abstract thinking skills, integration has always been encouraged in all areas of learning. In principle, teaching students how to write in English does not mean that one is limited to teaching English as the sole concept to be discussed. Teachers can encourage students to write their ideas on science concepts. This way, students are practicing and enhancing their writing skills while also tapping on their science process skills such as organizing, observing, classifying, inferring, relating, predicting, communicating, interpreting and analyzing which can be utilized in writing as well. Further, activities that develop abstract thinking skills are recommended to be employed in English class especially when the objective is to develop their writing skills. Activities that enhance students' ability of detecting patterns and relationships and solving complicated problems should be given before the writing process. This can initially trigger their cognitive abilities and overtime develops their abstract thinking skills. Hence, foregrounding these three cognitive constructs- English proficiency, Science process skills and abstract thinking skills- in ELT multilingual classroom is vital in developing students' writing skills.

4 Conclusion

The study revealed that among the cognitive constructs examined—English proficiency, reading comprehension, science process skills, quantitative skills, and abstract thinking skills—only English proficiency, science process skills, and abstract thinking skills significantly predicted first-year college multiligual students' writing performance across the dimensions of lexical resource, grammatical range and accuracy, coherence and cohesion, and task achievement.

English proficiency emerged as the strongest predictor, affirming its foundational role in developing accurate, coherent, and well-structured written discourse. Science process skills likewise contributed to writing proficiency, demonstrating the transferability of scientific reasoning—such as classifying, inferring, and communicating—to effective written expression. Similarly, abstract thinking skills significantly influenced writing performance, underscoring the importance of higher-order cognitive abilities such as pattern recognition, analysis, and problem-solving in producing cohesive and precise compositions.

Overall, the study underscores the importance of a multifaceted approach to writing instruction**.** English proficiency should be strengthened as a foundational element, while activities that engage science process skills and abstract thinking should be integrated into the curriculum to support higher-order writing development. Teachers are encouraged to design writing tasks that not only focus on language mechanics but also promote cognitive engagement, problem-solving, and analytical thinking. By foregrounding these three constructs—English proficiency, science process skills, and abstract thinking—ELT multiligual classrooms can more effectively develop students' competence in writing across multiple dimensions.

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