

English Language Proficiency and Geometric Proof Skills of Students

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Abstract

Educational reforms and curriculum development were continuously implemented for quality and inclusive education for all learners. As proficiency in English language became an issue, it has also been a burden in studying mathematics, specifically geometry, which is mainly written and taught in English Language. Hence, this study utilized descriptive correlational design in describing the students' proficiency in English language, specifically in reading comprehension, and Geometric proof skills in terms of correctness, appropriateness, logical reasoning, and clarity. Additionally, random sampling technique was used in choosing 30 mathematics students at a state university in Laguna. The quantitative data revealed that the respondents were proficient in terms of reading comprehension. However, with the presence of socio-cultural differences, their answers were influenced by environmental interference. On the other hand, the students performed advanced level in all aspects of Geometric proof skills. It was also found out that there is a significant relationship between reading comprehension and the correctness of proof and logical reasoning. Contrary to the results of the two components of geometric proof skills, reading comprehension has no significant relationship to both appropriateness and clarity. Based from the findings, the study suggests educators expose their students to a wide variety of reading materials in enhancing geometric proof skills.

Keywords: *English Language Proficiency, Geometric Proof Skills, Reading Comprehension*

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1. Introduction

In terms of reading and mathematics, the Philippines ranked last among 79 participating countries in the Program for International Student Assessment (PISA) 2018, with scores of 340 and 357, respectively, far exceeding the average of 487 for reading and 489 for mathematics (OECD, 2019). In order to achieve the goal of becoming a globally competent nation, education reforms were implemented with the goal of improving quality in the fields of science and mathematics. These subjects should be prioritized by administration and school systems in their program thrust (Akbasli et al., 2016).

Aside from its complexities and applications in scientific advancement, the beauty of mathematics involves an exclusively unique language unbounded by any cultural differences or socio-economical conflicts (Jourdain & Sharma, 2016). It employs a set of mathematical symbols and graphical representations to accomplish a specific purpose and function (Lin & Yang, 2007). However, problems and misunderstandings will arise when students experience contrast and information-clash when they bring up their prior knowledge when studying mathematics (Barwell, 2011). Aside from the difficulties encountered in the cognitive domain, mathematics presents significant difficulties in the use of language (Jourdain & Sharma, 2016). If a person does not understand English, he or she will not be able to understand a text written in English (Baful & Derequito, 2022). A person who knows nothing about English, for example, is always behind in analyzing information and technological discoveries that are mostly written in English Language (EL) (Racca & Lasaten, 2016). According to Aina et al. (2013), subjects such as mathematics and science necessitate extensive adaptation of language and its functions. The use of language is directly proportional to the effectiveness of one's thinking. As a result, language proficiency—in this case, EL—determines student performance in academic subjects, particularly mathematics.

One of the most important aspects of EL proficiency is reading comprehension (Racca & Lasaten, 2016). Some people read simply, but comprehension extends beyond the content of the text to include the secrets, stories, and context of a reading material (Akbasli et al. 2016). The reader and the text should communicate in a way that benefits both of them (Onkoba, 2014). Decoding symbols and solving problems using different arithmetic operations may not be enough in mathematics subject reading; students must first appreciate the holistic view of what

they are reading before they understand how they are going to solve a problem or perform in this task, mathematically (Barwell, 2011). Language translation is another issue that arises when learning mathematics. Mathematics contains specialized symbols that make it difficult to interpret mathematical text. Learners becoming lost in translation is a result of issues with syntax, semantics, and language consistency while attempting to comprehend a specific math problem (Njagi, 2015). Because of the additional process of translating one text for it to be understandable, English language learners may fall behind native language speakers.

The study of Perez and Alieto (2018) focused on instilling the idea of preventing problems from occurring by constantly revising school systems and curriculum in the early grades. For instance, language shift from English to mother tongue is one of the Department of Education's curriculum amendments, in which simple mathematical concepts such as basic arithmetic operations are translated to the language in which the child is proficient. This has an impact on students in the early grades, specifically grades 1 to 3. According to Perez and Alieto (2018), addressing language issues in childhood and the early stages of learning becomes proactive in addressing potential problems in higher education and promotes progress in both mathematical achievement and proficiency. According to Onkoba (2014), lack of mastery in various fields of mathematics does not directly determine a student's performance in the subject; rather, poor performance is the result of poor acquisition of language skills. Similarly, poor language skills predictably lead to poor mathematical skills. This was congruent to several studies that English Language Proficiency (ELP) predicts academic excellence in mathematics (Henry et al., 2014; Racca & Lasaten, 2016).

Some curricula for education students majoring in mathematics were designed to begin with the fundamentals—functions and definitions of mathematical theorems, properties, or propositions—in their first and second years of study. Meanwhile, junior and senior years require a higher level of reasoning, proof-skills, and the ability to apply knowledge gained in the first two years of learning. Learning mathematics will be difficult if EL is difficult to use and ELP is lacking (Rambely et al., 2013). This shortcoming may be taken into account and result in danger, as well as another shortcoming, a few years later while they are teaching. Although the PISA 2018 results placed an emphasis on mathematical literacy and reading comprehension, they do not directly include mathematical proof skills, particularly geometric proofs skills (Sälzer &

Roczen, 2018). However, Gunhan (2014) found that reading comprehension, along with reasoning and proof-making skills, determines mathematical achievement. Geometric problems are designed to assess cognitive skills in problem solving or reasoning, resulting in an assessment of reading ability in mathematics. Individuals who argue in a reasonable manner are also those who produce accurate proofs and communicate them to others in written form (Gunhan, 2014; Baful & Derequito, 2022).

Some notable recommendations from previous research studies include establishing relationships between English language proficiency and a much more specific field of mathematics. Gunhan (2014) emphasizes the effects of language proficiency in reasoning in his study and then connects it to how students reason out in mathematics by making proofs. Higher thinking requires both language skills and mathematical reasoning, such as proving geometric figures and other geometry problems (Perez & Alieto, 2018). To fill the gaps previously identified in this study, this study sought to understand the relationship between pre-service mathematics students' English language proficiency and geometric proof skills. This group of students was chosen specifically because they are actively immersed in the areas of Geometry and English as part of their preparation to be future mathematics teachers.

2. Literature review

2.1. Cognitive Academic Language Proficiency

The study was founded on the concept of Cognitive Academic Language Proficiency (CALP), which was coined in 1979 by Cummins (Macaro et al., 2018) and later became the central idea of Krashen and Rosenthal (Long, 2014) studies that determined the relationship between students' cognitive and linguistic processes and their academic performance. Language can be difficult for English language learners because it does not eliminate the impediment of cultural differences. Although the mathematics subject was unbounded by these differences due to universally accepted functions and symbols, proving geometry problems was not limited to specific functions; it also discussed logical reasoning and other aspects (Barwell, 2011).

CALP is a formal approach to introducing language proficiency in an academic setting. It is required in classrooms and educational institutions for activities such as reading, writing, joining and participating in formal conversations, and even taking quizzes and exams. As a result, students who do not incorporate CALP into their development are more likely to struggle

with subjects such as mathematics and other academic subjects (Long, 2014). While learning their first language or mother tongue, all children developed BICS. Meanwhile, CALP is acquired through a series of cognitive processes in which the individual engages during his or her learning journey (Racca & Lasaten, 2016). This study concentrated on CALP.

The findings of Krashen and Rosenthal (Macaro et al., 2018) demonstrate that problems with CALP and language proficiency can lead to deficiencies in mathematics learning. Reading comprehension was one of the dimensions of language proficiency (Zheng & Cheng, 2008). On the other hand, the method of assessing students' geometric proof skills was dynamic and relative in nature. Although interpretations may change depending on the students' progress and proficiency, the following dimensions will remain in proof making: correctness, appropriateness, logical reasoning, and clarity (Balacheff, 2008). As a result, the CALP theory gave the researcher a reason to investigate the relationship between students' English language proficiency and geometric proof skills.

2.2. Reading Comprehension

Reading comprehension extends beyond the content of the text to include the secrets, stories, and context of the reading material (Akbasli et al., 2016). Reading comprehension in mathematics involves not only decoding symbols and solving problems using various arithmetic operations, but also appreciating the holistic view of what they are reading before they understand how they are going to solve a problem or perform in this task, mathematically (Barwell, 2011).

Mathematics is known for its specialized symbols, which make it difficult to interpret mathematical text. Learners are getting lost in translation because of issues with syntax, semantics, and language consistency while attempting to understand a specific math problem (Njagi, 2015). Because of the additional process of translating text for understandability, English language learners are one step behind their native language speakers' counterparts. In terms of mathematical translation, graphical and symbolic representations are converted to mathematical equations or functions, and vice versa (Malanog & Aliazas, 2021). Unlike language translation, which has a bias in its native speaker, mathematical translation is unbounded by culture and language and can only be determined by the student's skills and systematic factors such as errors in representation or an incomplete understanding of the text (Adu-Gyamfi et al., 2012).

People regard writing in academe as grammatically complex and structurally listed in detail, such as research writing, proof writing, or even working on problems. However, before educating, the key to writing is communication; people cannot comprehend a complex structure if they do not first understand it (Biber et al., 2016). Writing can be examined through a composition based on the information given through sentences outline, pictures, and so on, thanks to technological advancement and the presence of infographics, graphs, and visual aids (Zheng & Cheng, 2008). Furthermore, writing is a complex tool that can change depending on the social context. Spence (2010) describes a learner who grew up in an English-speaking environment with far more potential than a learner who does not. Language combinations in terms of listening, speaking, reading, and writing are rooted in social situations, historical events, and sometimes norms.

Reading assesses students' abilities to comprehend written texts in nature. Reading comprehension can be measured using two components (Zheng & Cheng, 2008). The first is in-depth reading, which is defined as the breadth of one's word knowledge. It indicates how much a person understands rather than how much a person knows about something. Reading in depth implies a significant difference from summary writing (Li & Kirby, 2015). Skimming and scanning, according to Sari (2016), are useful methods for reading quickly and effectively. Skimming is reading the entire reading material in order to determine its nature and how it is organized, whereas scanning is quickly reading through the text in order to find a specific piece of information.

2.3. Correctness

Correctness necessitates completeness. The key to determining the correctness of a proof in writing mathematical proof—specifically in geometric proofs—is its completeness. Proofs are a series of reasons in chronological order that cannot be simply jumbled out (Lee, 2012). In some cases, the premise "congruent parts of congruent triangles are congruent" cannot be used to prove the congruency of two triangles without first proving that the triangles are congruent. The polished product—the end result—is the correct proof we see. The trials and errors of proving a specific statement or premise cannot be included in the definition of proving. Rather than being creative, we define correct as something that is only right and proper (Selden & Selden, 2015).

2.4.Appropriateness

The process of analyzing appropriateness includes arguments such as answering questions that examine the property of the proof methods, affirming and denying claims based on truth value, using acceptable theorems and polygon definitions, and a conscious assessment of whether a proof or something was correct or not (Selden & Selden, 2015). Appropriateness and correctness were diametrically opposed.

Appropriate does not imply correct. For example, the statement to be proven could be that two triangles in a quadrilateral are congruent. The statement can be proven using postulates and congruency properties. However, there may be properties of a quadrilateral that are misleading or inappropriate and can be removed during the proof process.

2.5.Logical Reasoning

According to Gunhan (2014), logical reasoning is the process of reasoning and justifying arguments in order to solve or contribute to the solution of a mathematical problem. Logical reasoning was gained by the situation in which they are forming their own conjunctures, which is rooted in elementary school level. Secondary level students improved on this by reasoning inductively and deductively after evaluating their own conjunctures. As a result of their lack of reasoning skills, learners tend to see mathematics as a set of rules that must be strictly followed rather than reasoned out for more flexible and complex learning. It is always critical that a claim be supported and defended by carefully constructed arguments. A good reasoning skill, on the other hand, should be relevant and have a clear manifestation in the classroom environment all the way up to the communities. Logical reasoning in geometry should extend beyond what is drawn, presented in figures, or written in books (Adu-Gyamfi et al., 2019).

2.6. Clarity

The fact that a proof is clear and understandable to the intended audience is proof of good proof-making and mathematical writing. Because there are numerous and diverse mathematical books that can be used as references, clarity in notation may differ in proving. However, there is a neutral common point where general clarity is required. For example, in the case of proofs other than direct proof, the writer who will create the proofs should specify the type of proof he

or she will use. Abbreviations should be avoided when writing proof because they impede understanding between the reader, particularly if the reader is inexperienced (Lee, 2012).

Precision is essential when writing proofs. To avoid misinterpretation and confusion, each mathematical statement should have a distinct meaning. Every proof should have a beginning and an end. Learners should be able to tell where your proof begins and ends (Lee, 2012). The ability to communicate in English determines mathematical achievement at the elementary and secondary levels of teaching and learning (Barley, 2011; Racca & Lasaten, 2016; Henry et al., 2014; Stoffelsma & Spooren, 2017; Rambely et al., 2013). A high level of mathematical achievement in childhood predicts a high level of mathematical reasoning skill later in life. Proof-making requires mathematical reasoning (Gunhan, 2014). However, no studies have been conducted to demonstrate that these three variables are transitive. A good command of the English language does not always imply a strong grasp of mathematics. However, based on the related literature, there should be a collaborative effort between the institution, as they control the content of education, teachers as they employ new and more efficient teaching methods, and students as they determine their pathways of deeper and purposeful learning.

3. Methodology

The purpose of this study was to look at the relationship between students' English language skills and their geometric proof skills. Its specific goal is to assess students' English Language Proficiency in reading comprehension as well as their geometric proof skills in terms of correctness, appropriateness, logical reasoning, and clarity. Finally, it attempted to establish a link between students' English language proficiency and geometric proof skills.

The study used the descriptive-correlational research design to answer questions in the problem statement and purpose of the study. The descriptive research design aims to observe a specific phenomenon rather than to answer whys and other questions about what is going on (Gravetter & Forzano, 2019). Correlational research design, on the other hand, seeks to discover systematic relationships between variables. It assesses two or more variables relevant to and related to the study (Gravetter & Forzano, 2019).

The study's respondents were second and third-year Bachelor of Secondary Education students majoring in Mathematics. These students were chosen specifically because they are currently preparing and training to teach mathematics in the Basic Education program. Using a

simple random sampling technique, the study identified thirty (30) students from both the second and third years of education who specialized in mathematics.

The modified tests that revolve on measuring the English language proficiency and geometric proof skills of mathematics students were the main instruments used in gathering data for this study. They were assessed using a battery of English language proficiency tests. The testing method was adopted and modified to meet the needs of the study (Zheng & Cheng, 2008). The study restricted the English language proficiency variable to reading comprehension only. Furthermore, the study adopted and modified the Copes-validated and used rubric for determining skills in geometric-proofs (Priest et al., 2013). To determine the level of English Language Proficiency, the series of reading comprehension tests about English language proficiency, consisting of three (3) tests in total and thirteen (13) questions each, was created. On the other hand, in order to determine the level of Geometric Proof Skills, the test that will measure the geometric proof skills was also created. Three (3) geometry proving problems on isosceles triangles, rhombuses, and parallel lines comprise the test.

The study sought the expertise of three English teachers for the English Language Proficiency Test and three Mathematics teachers for the Geometry Problems Test to ensure the content validity of both the adopted and modified tests. Validators for the English language proficiency research instrument corrected all grammatical errors in both the article and problem sets. They also eliminated all of the questions that they believed were more difficult than the others, reducing the number of questions on each test from fifteen (15) to thirteen (13). Meanwhile, validators with geometric proof skills suggested that the number of problem sets be increased. The number of problem sets, specifically geometry problems, was increased from two (2) to three (3). Another validation procedure was then applied to the additional problem.

Following the validation of the research instrument, the letter of approval was sent and permission was requested to administer the research to the college dean as well as the respondents. Following approval from the college dean, the English Language Proficiency tests were administered to all study participants. Following the completion of the three (3) parts of 13-question problems, the geometry proof problems and the three (3) given problems by two-column proofs were also administered. Google Forms was used to administer all of the tests. The test questionnaires were collected thereafter.

The current study employed both descriptive and inferential statistics. Frequency and percentage were used in response to the descriptive analysis on English Language Proficiency and Geometric Proof Skills. Spearman rank correlation was used to answer the inferential question of whether there is a significant relationship between students' English Language Proficiency and Geometric Proof Skills.

The study ensured confidentiality of the results and the respondents' personal information. It was also optional for respondents to provide their names.

4. Findings and Discussion

Table 1

Students' English Language Proficiency Level in terms of Reading Comprehension

Scores	Frequency	Percent	Interpretation
Test 1			
11-13	14	46.6	Exemplary
8-10	13	43.3	Proficient
5-7	1	3.3	Developing
0-4	2	6.6	Emerging
Test 2			
11-13	4	13.3	Exemplary
8-10	10	33.3	Proficient
5-7	10	33.3	Developing
0-4	6	20.0	Emerging
Test 3			
11-13	4	13.3	Exemplary
8-10	12	40.0	Proficient
5-7	12	40.0	Developing
0-4	2	6.6	Emerging

Table 1 presents the respondents' English language proficiency in terms of reading comprehension for all the three tests.

In the first test, it can be seen that fourteen (14) respondents (46.6 %) out of thirty (30) achieve an exemplary level. This means that the majority of respondents have an exemplary level of reading comprehension. Students who perform exceptionally well receive scores ranging from

11 to 13. This demonstrates that the majority of students understood the reading materials and the corresponding questions with little to no error. On the other hand, 13 students or 43.3 percent are proficient, one (1) or 3.3 percent is developing, and two (2) students or 6.6 percent of respondents received 0-4 scores in the emerging level. Average scores can also be used to describe the proficient level. Students at this level answered questions with consistency and accuracy, but they missed some difficult questions. In comparison to the rest of the respondents, the two students at the emerging level did not exhibit clear patterns in their responses.

The instrument in test 1 is an article about scientific facts and cannabis plant terminologies. Similar to mathematics, cultural differences have no bearing on scientific facts and terminologies (Jourdain & Sharma, 2016). There will be no internal conflict or other factors that could influence how respondents answer the test.

In test 2, it is revealed that 10 (33.3 %) of respondents are proficient and developing, emerging, 6 (20 percent) of respondents, and only 4 (13.3 %) of respondents are exemplary. The difference in level of scores and frequencies between tests 1 and 2 is very noticeable. The frequency of the student who performs exemplary drops from fourteen (14) to four (4), in terms of percentage, the percentage decreases by one-third (33.3%), while the students who are in developing level increased by nine (9) from one (1) accounting to nearly 30 percent of de-escalations.

The research of Akbasli et al. (2016) suggests possible explanations for sudden changes in score frequencies. They stated that there are times when testing reading comprehension that the students' prior experience and current knowledge of a topic influence how well they comprehend a written article. For example, the research instrument for test 1 is about scientific facts and terminologies about cannabis and the marijuana plant, whereas the research instrument for test 2 is about China's territorial usurpation in countries such as Myanmar, Malaysia, and Japan. Personal biases of respondents may hinder and overlap the idea presented in the article because context differences are present and much more observable in test 2.

In test 3, the proficient and developing levels have equal frequencies, accounting for (12) twelve, or 40% of the respondents in each category. Furthermore, (4) four students, or 13.3 %, reach the exemplary level, while (2) two students, or 6.6 %, fall into the emerging level. Students at the proficient level are not expected to perform exceptionally well in the presence of an article that is completely unfamiliar to the respondent's profile; rather, they are expected to perform

averagely. The results of the respondents' scores mirrored the researcher's expectations. When compared to test 1, the results of test 3 are much more similar to those of test 2. In comparison to the results of test 2, the frequencies for developing and proficient level both increase by 6.6 percent (13.3 % in total), with the four (4) students from emerging level accounting for this increase. There are some shared similarities between the articles on test 2 and test 3. The second test focused on China's territorial usurpation of Southeast Asian countries, while the third examines the methods of evaluating a manager in a company. Both are uncommon in the respondent's daily life. China's move is distinct from that of other countries, and methods of assessment in the workplace differ in terms of teaching. According to Spence (2010), language proficiency in terms of reading comprehension is a result of social differences. Reading proficiency can be influenced by social situations, historical events, and sometimes norms.

Table 2

Students' English Language Proficiency Level in terms of Reading Comprehension in Series of Tests

Scores	Frequency	Percent	Interpretation
11-13	5	16.6	Exemplary
8-10	16	53.3	Proficient
5-7	6	20.0	Developing
0-4	3	10.0	Emerging
Total	30	100.0	

Table 2 summarizes the frequencies of the average (mean) scores of students in the series of reading comprehension tests. More than half of the respondents, or 16 students (53.3 percent), demonstrated a proficient level of performance. In a series of tests, the majority of the students' average scores fall in the proficient range. When compared to the results of the second and third tests, the percentage of students performing at the proficient level increased. This is due to their performance on the first test, in which the majority of students performed admirably. When the average scores were computed, some of the developing level scores were elevated one category above their usual scores.

Meanwhile, six students (20% of the respondents) perform at the developing level, five (5) or 16.6% perform at the exemplary level, and three (3) represent 10% perform at the emerging level. Even if students are proficient in reading comprehension, problems with consistency or retention may arise when students encounter contrast and information-clash when

applying their prior knowledge to the article they are reading (Barwell, 2011). In terms of testing, the difficulty or nature of the tests has a significant impact on students' reading comprehension (Baful & Derequito, 2022). Language teachers should expose their students to a wide range of reading materials in order to improve reading comprehension in terms of level and consistency.

Table 3

Students' Level of Geometric Proof Skills in terms of Correctness

Scores	Frequency	Percent	Interpretation
Correctness			
3	17	56.7	Advanced
2	12	40.0	Proficient
1	1	3.3	Beginner
Appropriateness			
3	19	63.3	Advanced
2	10	33.3	Proficient
1	1	3.3	Beginner
Logical Reasoning			
3	19	63.3	Advanced
2	10	33.3	Proficient
1	1	3.3	Beginner
Clarity of Notation			
3	18	60.0	Advanced
2	9	30.0	Proficient
1	3	10.0	Beginner

Table 3 shows the students' geometric proof skills in all the four skills tested.

In terms of correctness, more than half of the respondents, 17 out of 30 (56.7 %), have advanced accuracy in their geometric proof skills. Students who advanced in their studies were able to provide correct and complete proof. Although the percentage of students who perform at the advanced level of geometric proof skills in terms of correctness is 56.7 %, which is a very large portion of the respondents, the frequency of students who perform at the advanced level is the lowest when compared to the other three components of geometric proof skills. Furthermore, 12 students (40 % of the respondents) have proficient skill levels, while only 1 student (3.3 %) falls short of the beginner level of correctness. Almost all of the respondents who reach the proficient level struggle to complete their proofs. Even if the respondents' proof is on the right track, they would have difficulty closing out their proofs. Students with proficient skill levels can

solve or prove the problem; however, they can be misguided while answering, resulting in an incomplete proof or even a significant unjustified leap in the answers. The only student at the beginner level was unable to submit an answer in all three problem sets, and it is possible that the student was unable to answer even one of them, given that the respondent's choice is pre-service math teachers.

According to Lee (2012), completeness is required in determining whether or not the proof is correct. Some proofs include irrelevant information and statements, while others lack relevant information. To increase the number of students performing at the advanced level, the teacher should place a greater emphasis on teaching complete and correct proofs.

In terms of appropriateness, 19 students, or nearly two-thirds of the class (63.3 %), demonstrate advanced level of skill in terms of selecting appropriate methods in their ways of proving. Even if the respondents demonstrate an advanced level of appropriateness, they share methodological similarities in their responses. There are no indications of a different approach. In terms of appropriateness, the 63.3 % frequency of respondents who reach advanced level of geometric proof skills can have a variety of implications. First, the students excel at selecting the most appropriate—that is, the simplest and shortest—methods and statements for proving their points (Selden & Selden, 2015). Another implication is that students are only taught the most appropriate methods of proving. Even though geometric proofs are non-routine problems that require creativity and critical thinking, they can sometimes be answered routinely (Dio, 2021). Problems with the latter implication may arise if students pursue a higher level of mathematics (Andrade & Pasia, 2020). Furthermore, 10 students (33.3 %) perform at the proficient level, while only 1 student (3.3 %) performs at the beginner level in terms of appropriateness. 10 students perform competently in terms of appropriateness; these students were able to select appropriate proof methods, but did not master them, resulting in incorrect assumptions in proofs. Similarly, only one (1) student performed at the beginner level in all components and was unable to answer the problem sets.

In terms of logical reasoning, 19 (63.3 %) of the respondents have advanced logical reasoning skills. Students with advanced logical reasoning abilities performed clear and correct statements in chronological order. The proper statement-reason arrangement accounts for the high frequency of students with high levels of logical reasoning (Mulligan, 2015). Enhanced logical reasoning has its roots in elementary and secondary school, where students improve their

reasoning skills by forming conjectures and reasoning inductively or deductively based on those conjectures (Gunhan, 2014). For example, first and second year college students' curricula focused on improving their fundamental math skills. The concept of line and polygon properties was discussed and taught as early as secondary school. In higher levels of mathematics, underdeveloped reasoning skills in childhood show rigid and narrow reasoning skills (Lowrie, Logan, & Ramful, 2016). Furthermore, 10 students (33.3 %) reason logically at the proficient level. The effect of having a proficient level in terms of logical reasoning is focused on the readers' ability to read the proof itself, rather than on the individual's skills. In the eyes of the evaluators, who are mathematics experts by profession, the proofs of students who perform proficiently were logically correct. When presented to someone who is not mathematically inclined, the proof is incomprehensible. These aspects or factors are critical in pre-service mathematics teachers because they will soon be in the classroom.

Furthermore, only one student (3.33%) performs at the beginner level of logical reasoning. The student did not complete proofs in all of the problem sets. Teachers and educational institutions should focus more on developing primary and secondary students' reasoning skills in order to retain and improve their students' logical reasoning.

In terms of clarity of notation, the highest frequency is still on the advanced level, which corresponds to 18 students and 60 %. The shift in educational reforms resulted in a high number of frequencies for advanced level geometric proof skills in terms of clarity (Rambely, Ahmad, Majid, & Jaaman, 2013).

In terms of clarity, nine (9) students, or 30% of the respondents, perform at the proficient level, while three students, or 10% of the respondents, perform at the beginner level. Clarity was assessed based on how respondents practiced accuracy in notation, such as assigning names to lines and angles, as well as the connection of the statement to the reason. The proof of the students with proficient levels is understandable in a simple manner, with the exception of a few parts that are unclear. Most students at the proficient level have a tendency to state and justify reasons incorrectly based on their corresponding statements. Furthermore, the proofs of students who performed at the beginner level are perplexing and disorganized. Beginners struggle to connect statements to their reasons and to use mathematical symbols.

The emphasis on discussing the fundamentals among first and second year students, such as functions and definitions of mathematical theorems, properties, or propositions, becomes

apparent in measuring achievement in higher math subjects such as proving. This implies that educational institutions should continue to emphasize the fundamentals and basics of basic mathematics in the early years of study (Rambely et al., 2013).

Table 4

Test of Relationship between English Language Proficiency and Geometric Proof Skills Components

Spearman's rho	English language Proficiency	Geometry Proof Skills			
		Correctness	Appropriateness	Logical reasoning	Clarity
		0.469**	0.327	0.434*	0.354

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Table 4 shows the relationship between students' English Language Proficiency and Geometric Proof Skills. Accordingly, there is a significant positive relationship between English language proficiency and geometric proof skills. It demonstrates a relationship between English language proficiency and the two components of geometric proof skills, namely correctness and logical reasoning. The findings support and align with Gunhan (2014) that geometry problems can influence students' reading comprehension and reasoning skills. Furthermore, the study connects issues of English language proficiency in terms of reading comprehension to reasoning and proof-making skills.

The correctness of the proof is related to the students' reading comprehension. Meanwhile, there are no clear links that correctness as a geometric proof has a relationship with English language proficiency. Geometry problems can benefit from reading comprehension. Proof-making, as defined by correctness, is the process of arranging things in the correct and proper order (Priest et. al., 2013). Teachers can improve geometric proof skills in the same way that they can improve reading comprehension by constantly teaching a wide variety of geometry proof problems. In terms of appropriateness and clarity, there is no significant relationship between English language proficiency and geometric proof skills.

The following are some of the possible reasons for the components such as appropriateness and clarity in the results. Respondents exhibit personal biases in answering reading comprehension articles that address socio-cultural text that is completely different from them, as the findings for reading comprehension imply (Barwell, 2011). Because of the issues in bringing their own personality in answering, this makes sense to the relationship of reading

comprehension to correctness and logical reasoning. For issues of appropriateness and clarity, the way these components are scored and measured is based on students' use of mathematical symbols and concepts in mathematics—these sets of symbols only serve specific functions and purposes and are unbounded by socio-cultural differences (Lee, 2012; Lin & Yang, 2007). Future researchers should look into other aspects of English language proficiency besides reading comprehension. Furthermore, future researchers should attempt to correlate reading comprehension to proofs in various branches of mathematics, such as logic or number theory.

5. Conclusion

The primary goal of this research is to look into the relationship between English language proficiency and geometric proof skills. Reading comprehension was discovered to have a significant relationship to both dimensions of geometric proof skills, such as correctness and logical reasoning. Reading comprehension, on the other hand, has no significant relationship with both appropriateness and clarity. Adjustments and actions are suggested in light of the study's findings and conclusions. To improve students' reading comprehension skills and consistency, the study suggests incorporating a wide range of different reading materials into teaching instructions. Similarly, further study could increase the number of respondents to strengthen the accuracy and validity of the outcome. Further studies can also use various proving strategies or proving in other branches of mathematics such as logic and number theory.

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