CORRELATION AMONG SEMANTIC, SYNTACTIC, PRAGMATIC, AND COGNITIVE BARRIERS TOWARDS ACCURACY GEOMETRY PROOFS

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Abstract: The purpose of this article is to discover the correlation among language elements- semantic, syntactic, pragmatic- and cognitive barriers towards the accuracy of Geometry proofs. This interdisciplinary study was carried out in response to the fact that students of Math neither focus on mathematical procedures nor integrate the topics of math into the representation of mathematical concept which brings about the constraint of achieving the goal of learning Math. This fact is resulted from either external or internal factors such as students' background knowledge that is influenced by cognitive or communicative factors. Thus, effective communication consisting of semantic, syntactic, and pragmatic can be big barriers towards achieving learning goal. This study was conducted through a correlational study with 30 students of Math Department, IAIN Tulungagung Indonesia as the sample out of 120 populations. They were selected randomly based on their own availability and willingness to seriously take part in this interdisciplinary research. The instrument used was a set of achievement Math test on *triangle congruency*. The findings of this study prove that there is a correlation and negative effect of semantic, syntactic, pragmatic, and cognitive barriers towards the accuracy of Geometry proof. The result of this study is pedagogically implemented for tutors of Math to consider either oral or written communicative barriers which inhibit the students' learning success in Math. Further studies on efforts of minimizing language barriers in Geometry proof accuracy is suggested to be conducted.
Keywords: *communicative barriers; cognitive barriers; accuracy of geometry evidences.*

INTRODUCTION

To have mathematical communication skills is essential to achieve the learning goal. Referring to Rohid & Rusmawati (2019), the skills cover students' ability to (1) arrange and link their mathematical thinking through communication; (2) communicate their logical and clear mathematical thinking to their friends, teachers, and others; (3) analyze and assess mathematical thinking and strategies used by others; and (4) use mathematical language to express mathematical ideas correctly. Such skills are important to explore and support their mathematical abilities (Hafifah & Bharata, 2018). However, Rohid & Rusmawati (2019) in their study found that only 1 out of 3 students of Junior High School in Indonesia is able to express mathematical ideas; understand, interpret and assess or respond to mathematical ideas; and use terms, notations, and symbols to present mathematical ideas. In Indonesian context, students' mathematical skills need to be improved. Another study (Fauziyah & Jupri, 2020l) ferret out that most students encounter problems in mathematical communication skills.

There have been studies related to language and mathematical communication skills which cover three areas. The first is problems and challenges in teaching and learning Mathematics. Some studies revealed a not well established system of Mathematic instruction (Tanujaya, Prahmana, &

Mumu, 2017), low communication skills and mathematical representations (Fauziyah & Jupri, 2020), mathematical problem solving (Martins & Martinho, 2021), cognitive obstacles (Herscovics, 2018), and misconceptions and other difficulties in syntactic knowledge, conceptual knowledge, and strategic knowledge (Qian & Lehman,2017). The second area of research in Math is ways to promote students' mathematical communication skills. Studies ferret out that students' mathematical communication ability can be promoted through Project based learning with scaffolding (Paruntu, Sukestiyarno, & Prasetyo, 2018), metacognitive based contextual learning (Ahdhianto & Santi, 2020), problem based learning (Surya, Syahputra, & Juniati, 2018), CORE (Connecting-Organizing-Reflecting-Extending) learning (Yaniawati, Indrawan, & Setiawan, 2019), Probing-Prompting based on Ethnomatematics learning (Hartinah et.al. 2019), PISA with Realistic learning (Sari, 2019), and Brain-Based Learning (BBL) approach with Autograph (Triana & Zubainur, 2019). The third area is learners' communication barrier. For example Ofulue (2011) investigated communication barriers in long distance class. Meanwhile, Ozmen, Akuzum, Muhammed & Selcuk (2016) studied communication problems between teachers and students' parents. Sbaragli et al.(2011) conducted a study on cognitive and epistemology barriers. Bishop et al (2014) researched barriers and competence on integers. Mallet (2012) studied the cognitive barriers on integral, and Magajna (2013) conducted a study on cognitive obstacles of the learners with insufficient knowledge. Meanwhile, Nyikahadzoyi (2013) studied only on the learners' cognitive problems. However, it is almost hardly found a study concerning with correlation among those barriers with the accuracy of the learners' Geometry proof. Thus, it is necessary to investigate the correlation between and among the barriers towards their accuracy of Geometry proof.

Taking a closer look at the above-mentioned facts, it is significant to carry out a study on finding out the correlation between the skills of mathematical communication and problem solving in Maths. There are three reasons underlining this interdisciplinary study. The first is language is considered as the key notion for the understanding of the complexity of Math (Planas,2018). He further explains that language is a shifting resource for the communication of tensions which consider languages of learners and the creation of newer situations toward the production of meaning taken as mathematical. Participants in mathematics lesson use their languages to communicate their mathematical thinking in the multilingual mathematics classroom. Consequently, language is variably realized within the network of options produced and activated at the intersection of language system, the language of mathematics and the language of instruction. The second reason is regarding the importance of language in Math. As proved by Peng et. all. (2020) that the language use for retrieving mathematics knowledge may be more important for foundational mathematics skills. This in turn can further strengthen linguistic thought processes to perform more advanced mathematics tasks. The more complicated language and mathematics skills are associated with stronger relations between language and mathematics. Furthermore, Perez & Alieto (2018) proved that the proficiency in the use of mother tongue has a very strong positive correlation with Math achievement. An effective communication either between students and students or between students and teachers becomes underlying factor of learning success. This communication process involves semantic, syntaxes, and pragmatic factors (Ongstad, 2006). The third is serious effort need to be given in order to reduce cognitive problems and thoughts which focus on helping the learners' cognitive barriers (Bishop et al., 2014). One of which is by discovering the correlation between barriers on mathematical communication skills and mathematical problem solving. This study is then intended to reveal what barrier which correlates to the learners' learning failure to accurately accomplish the task and to know whether each barrier affected each other.

METHOD

This research employed correlational study. The population of this study were 120 students of Math Education Department of IAIN Tulungagung, Indonesia who learned Euclid Geometry. The material learned in this subject is *Geometry Proof.* The sample was selected randomly by asking those who were available and willing to take part seriously in this research. There were 30 students selected as sample who were not forced to get involved in this research because they were asked to do the test.

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The object of investigation in this present research was *triangle congruency*. This material needs to be comprehensively understood about *axiom, theorem, definition, and their uses* during the process of proving. This material did not only require cognitif competence, but the skills of constructing and arranging argumentative sentences appropriate to the context as well. Thus, there was a complexity of competence namely cognitive and communicative competences which need to be achieved by the sample. Those competences were used as the underlying basis to measure their competence to construct proof sentences. Accordingly, the predictor variables of this research were semantic ($X_{1)}$), syntaxes (, $X_{2)}$), pragmatic ($X_{3)}$ and cognitive ($X_{4)}$ barriers. The dependent variable *(Y)* is the accuracy of Geometry proof.

The instrument used to collect the data in this research was a set of achievement test which consisted of 4 questions asking about how to prove the accuracy of Geometry. It was written in *Bahasa Indonesia*- the sample's mother tongue. The test is divided into two types of question- pictured question and narrative questions. The first type comprised 2 questions which were equipped with pictures and known elements. The latter one consisted of two narrative test items without pictures. It was developed through the following steps: 1). Arranging indicators and descriptor of test ítems; 2). Developing test; 3) developing rubric for test validation; 4). Conducting expert validation; 5). Conducting try out test; 6). The test was used to collect data if they are valid and reliable; 7). The questions selected are the ones with the highest validity of the two types of questions; 8). If the questions are not valid and reliable yet, then the steps of test development are repeated. The validity of the instrument was tested using Pearson Correlation which showed that the Sig. score is less than *0,05*. Meanwhile, its validity is done by taking a look at the scores of Alpha Cronbach's which shows *0,848* showing its high reliability.

The design of this research was as follows: The researchers 1). decided the materials of the research, namely *triangle congruency;* 2). Arranged indicators and descriptors of the materials; 3) arranged indicators and descriptors of the constraints; 4). Developed instrument and scoring rubric; 5). Conducted expert validation; 6). Revised draft of instrument based on the feedback given by the expert; 7). Conducted try out test to students sharing common characteristics with the sample of the research; 8).Conducted validity and reliability test; 9). Selected test items which have high validity of both types of questions; 10). Conducted test to the sample of the research; 11). Did Scoring and tabulating the score obtained from the sample of this research; 12). Conducted test requirement and hypothesis; 13. Drew conclusion from the result of hypothesis test

FINDINGS AND DISCUSSION

This research is intended to see both the correlation between predictor and dependent variables and their effects predictively. The collected data were tested by using multi regression test and simple regression test for each predictor variable towards dependent variable ($Y = a + bx$.).

The result of simple regression test of semantic barrier ($\mathbf{X_1}$) towards geometry proof accuracy (Y)

This hypotheses testing is aimed at knowing whether the coefficient regression is significant or not. The hypothesis to be tested is whether there is significant effect of semantic barrier ($\mathbf{X_1}$) towards accuracy proof (Y).

Table 1. *Correlation between semantic barrier and accuracy proof*

Correlations

		Accuracy Proof	Semantic Barrier
Pearson Correlation	Accuracy Proof	1.000	-.486
	Semantic Barrier	-.486	1.000
Sig. (1-tailed)	Accuracy Proof	.	.003
	Semantic Barrier	.003	.
N	Accuracy Proof	30	30

Correlations			
		Accuracy Proof	Semantic Barrier
Pearson Correlation	Accuracy Proof	1.000	-.486
	Semantic Barrier	-.486	1.000
Sig. (1-tailed)	Accuracy Proof	.	.003
	Semantic Barrier	.003	.
N	Accuracy Proof	30	30
	Semantic Barrier	30	30

Table 1 shows that coefficient correlation between semantic barrier and accuracy proof is -*0,486* which means that there is negative correlation between the two variables. This correlation is defined as the higher the semantic barrier the weaker the accuracy proof. The score of R square as seen in Table 11b. is 0,236. This number indicates that the semantic barrier contributes 23, 6% to the accuracy of arranging proof, and *76, 4 %* is determined by the other factors. That percentage points out the contributing number of semantic competence in doing accuracy proof of Geometry. The strength of Geometry proof is partly dependent on the students' semantic competence-the way defining and comprehending any Math symbols employed in the test items. Either students or teachers should then notice the importance of semantic knowledge and competence in producing accurate proof in Math. This finding supports Mimau et.al. (2019) who proved that syntactic awareness acts together with semantics in order to foster the use of context in word reading such as narrative Math test item.

Table 2. *Correlation between semantic barrier and accuracy proof*

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.486[a]	.236	.209	24.005
a. Predictors: (Constant), Semantic Barrier				

Meanwhile, it is found that the score of Sig is *0,007* and it is smaller than 0, 05. Thus, it is feasible to be continued doing regression test in order to see how much semantic barrier towards accuracy proof can be predicted. In addition, the result of simple linier regression equation found is $Y = 67,813 - 0,643\ x$ which indicates that the semantic barrier (X1) negatively affects the proof accuracy (Y). This means that for every increase in the value of x by one unit, the value of Y will decrease by 0, 643 units.

The result of simple regression test of syntactic barrier (X_2) towards geometry proof accuracy (Y)

The result of correlation test as seen in Table 2a shows that the ccorrelation coefficient between Semantic Barriers and Proof Accuracy is - 0.907. This indicates that there is a very strong correlation between syntactic barriers to the accuracy of evidence. A negative sign indicates a negative relationship, the higher the syntaxes obstacles, the weaker the proof produced. This indicates that syntax-related Math is influential in learning Math as proved by Klibanoff et .al. (2006) that teachers' math-related talk was related significantly to the growth of preschoolers' mathematical knowledge. Further study has indicated that algebraic systems can be taught using generalizations from written English syntax (Ostler & Bruckner, 2017)

Table 3. *Correlation between semantic barrier and the proof accuracy*

Correlations			
		Accuracy proof	Syntaxes Barrier

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Pearson Correlation	Proof Accuracy	1.000	-.907
	Syntaxes Barrier	-.907	1.000
Sig. (1-tailed)	Proof Accuracy	.	.000
	Syntaxes Barrier	.000	.
N	Proof Accuracy	30	30
	Syntaxes Barrier	30	30

. Table 4. *The effect of semantic barrier towards the proof accuracy*

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.907[a]	.823	.817	11.549

a. Predictors: (Constant), Syntaxes Barrier

b. Dependent Variable: Proof Accuracy

Table 4 shows that the score of R square is 0,823. This coefficient of determination indicates that the syntactic constraints 82.3% contribute to produce the proof accuracy, while 17.7% was determined by other factors. Thus, it can be said that the syntactic barriers have a strong influence to produce the correct Geometry proof. Mahfudy (2017) in his study revealed that students employ *syntactic proof production type* consisting of identifying and manipulating the statement or information in the question, translating the information in the question, choosing the relevant theorem, using formal mathematical symbol or notation in conducting the proof stage, using sketch, and making conclusion from every statement. This indicates that syntax correlate with the success or failure of the geometry proof. In addition, the result of Anova test that the Sig score is 0,000 and it is smaller than 0, 05. This demonstrates that the syntactic barrier is predicted to be significant towards the proof accuracy of Geometry.

Table 5. *The significance of Anova testing on the effect of syntactic barriers towards proof accuracy*

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17381.346	1	17381.346	130.305	.000[a]
	Residual	3734.909	28	133.390		
	Total	21116.255	29			

a. Predictors: (Constant), Syntaxes Barrier

b. Dependent Variable: Proof Accuracy

So, it can be predicted that Syntactic Barriers (X_2) negatively affect the Accuracy of Proof (Y). Moreover, it can be stated that for each increase in the score of x by one unit, the score of Y will decrease by 0.961 units. Based on the score of a and b obtained, the regression equation can be written Y = 91.559 - 0.961x. The regression coefficient is minus. Then it can be predicted that the Syntactic Barriers (X_2) negatively affect the Accuracy of Proof (Y). Furthermore, it can be stated that for each increase in the score of x by one unit, then the score of Y will decrease by 0.961 units.

Table 6. *The predictive effect of syntactic barrier towards proof accuracy*

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	91.559	4.707		19.451	.000
	Syntactic Barrier	-.961	.084	-.907	-11.415	.000

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	91.559	4.707		19.451	.000
	Syntactic Barrier	-.961	.084	-.907	-11.415	.000
a. Dependent Variable: Proof Accuracy						

The result of simple regression test of pragmatic barrier (X_3) towards geometry proving accuracy (Y)

Pragmatic barrier is concerned with how to define meaning from context either problem or proving contexts. In this research, it was found that the coefficient correlation between pragmatic barrier and Geometry proving accuracy arranged by Math students is - *0,745* (See Table 16). This shows that there is a strong negative correlation between pragmatic barriers and Geometry proof accuracy- the higher the pragmatic barriers, the weaker the proof accuracy.

Table 7. *Correlation between pragmatic barrier and accuracy proof*

Correlations			
		Proof Accuracy	Hambatan Pragmatic
Pearson Correlation	Proof Accuracy	1.000	-.745
	Pragmatic Barriers	-.745	1.000
Sig. (1-tailed)	Proof Accuracy	.	.000
	Pragmatic Barriers	.000	.
N	Proof Accuracy	30	30
	Pragmatic Barriers	30	30

Then, it was found that R Square showing the strength of the effect of Pragmatic barriers towards proof accuracy in Geometry. Table 7 shows that the score of coefficient determination coefficient is *0,555* which mean that the contribution of pragmatic barrier towards the accuracy of Geometry proof is 55.5% and the rest 44, 5% is affected by the other factors.

Table 8**.** *The effect of pragmatic barriers towards proof accuracy*

Model Summary[b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.745[a]	.555	.540	18.310
a. Predictors: (Constant), Hambatan Pragmatic				
b. Dependent Variable: Proof Accuracy				

Meanwhile, the significance of its effect can be seen from the Sig. score of Anova Testing and it was found that it is *0,000* (See Table 7). Since the Sig. score is smaller than *0, 05,* it can be sum up that there is significant effect of pragmatic barrier towards Geometry accuracy proof.

Table 9. *Significance of Anova testing on the effect of pragmatic barrier towards geometry accuracy proof*

ANOVA[b]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11728.723	1	11728.723	34.983	.000[a]
	Residual	9387.532	28	335.269		

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Total	21116.255	29			

a. Predictors: (Constant), Pragmatic Barrier
b. Dependent Variable: Accuracy Proof

This can also be found that the predictive regression equation of pragmatic barriers towards Geometry accuracy proof is Y = 77,029 – 0,894x (See Table 8). Because the score of regression coefficient is minus (–), it can be predicted that pragmatic barrier (X_3) negatively influence the Geometry accuracy proof (Y). It can also be stated that each increase in the score of x by one unit, then the score of Y will decrease by *0,894* units.

Table 8**.** *Regression equation on the effect of pragmatic barriers towards geometry accuracy proof*

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	77.029	6.578		11.709	.000
	Pragmatic Barrier	-.894	.151	-.745	-5.915	.000

a. Dependent Variable: Proof Accuracy

The result of simple regression test of cognitive barrier (X_4) towards geometry proving accuracy (Y) This cognitive barrier refers to the one in understanding the content of the materials which covers understanding on definition, axiom, and theorem. The result of correlation test (see Table 9) shows that the score of correlation coefficient between cognitive barrier and Geometry accuracy proof is **-** *0,881*. This score indicate strong negative correlation between the two variables meaning that the higher the cognitive barrier the weaker the accuracy proof made.

Table 9. *Correlation between cognitive barrier and accuracy proof*

Correlations			
		Proof Accuracy	Cognitive Barrier
Pearson Correlation	Proof Accuracy	1.000	-.881
	Cognitive Barrier	-.881	1.000
Sig. (1-tailed)	Proof Accuracy	.	.000
	Cognitive Barrier	.000	.
N	Proof Accuracy	30	30
	Cognitive Barrier	30	30

Meanwhile, the effect of cognitive barrier towards the Geometry accuracy proof can be seen in Table 10. The score of R Square is *0,777* which means that its determination coefficient is 77, 7%. This can be noted that 77, 7% accuracy proof is affected by cognitive barrier and the rest 32, 3% is the other factors which might influence the learners' Geometry accuracy proof. Noto et.al (2019) who studied about learning obstacles on transformation Geometry found that the learning obstacles are related to cognitive factor such as applying the concept, visualizing, principle, understanding of the problem and how to prove.

Table 10. *The effect of cognitive barrier towards geometry accuracy proof*

Measures of Association				
	R	R Squared	Eta	Eta Squared
Proof Accuracy * Cognitive Barrier	-.881	.777	.892	.795

Then, whether such an affect is significant or not can be seen in Table 11. From the Table, it can be found that the Sig. score (.000) < 0, 05 which demonstrates that there is significant effect of cognitive barrier towards Geometry accuracy proof.

Table 11. *Significance of Anova testing on the effect of pragmatic of cognitive barriers towards geometry accuracy proof*

ANOVA[b]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16397.892	1	16397.892	97.309	.000[a]
	Residual	4718.363	28	168.513		
	Total	21116.255	29			
a. Predictors: (Constant), Cognitive Barriers						
b. Dependent Variable: Accuracy Proof						

Subsequently, to know how much the correlation between cognitive barrier and accuracy proof can be taken into a look at Table 12 below. The table tells that the score of *a = 93,051* and *b = – 0,974*. The common regression equation is *Y = a + bx*. Thus, on the basis of the result of count score, the regression equation is *Y = 93,051 – 0,974x*. Since the score of regression coefficient is minus (–), then it can be predicted that cognitive barriers (X_4) has negative influence towards accuracy proof (Y). In addition, it can be sum up that each increase in the score of x by one unit, and then the score of Y will decrease by *0,974* units

Table 12. *Regression equation on the effect of cognitive barriers towards geometry accuracy proof*

Coefficients						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	93.051	5.552		16.758	.000
	Hambatan Cognitive	-.974	.099	-.881	-9.865	.000
a. Dependent Variable: Accuracy Proof						

The result of multiple regression test: semantic, syntactic, pragmatic, and cognitive barriers towards accuracy proof

This kind of test is done in order to if there is any effect of semantic, syntactic, pragmatic, and cognitive barriers towards Geometry accuracy proof done by Math students. The process of finding out the answer is started from looking at the scores of mean, deviation standard, correlation test, the effect, significant effect, and regression equation used to predict the accuracy of the answer when the learners encounter semantic, syntactic, pragmatism and cognitive barriers. Table 13 indicates that the result of the descriptive statistic shows that the mean score of the accuracy proof is *43, 52* and its deviation standard is *26,984*. This means indicates that the learners' competence to do Geometry proof is relatively low.

Table 13. *Descriptive statistic of barriers and accuracy proof*

Descriptive Statistics			
	Mean	Std. Deviation	N
Accuracy Proof	43.52	26.984	30
Semantic barrier	37.78	20.381	30
Syntactic barrier	50.00	25.480	30
Cognitive barrier	50.83	24.404	30
Pragmatic barrier	37.50	22.505	30

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Meanwhile the mean score of semantic, syntactic, cognitive, and pragmatic barriers are sequentially *37,78; 50,00; 50,83; 37,50* with each sequential Deviation Standard is *20,381; 25,480; 24,404; 22,505*. This finding shows Math students tend to experience obstacles in doing Geometry proving as also revealed by Noto et.al (2019). The biggest barriers are on cognitive and syntactic. Then the correlation of each barrier toward accuracy proof can be seen Table 14. There are some points that can be noticed from the Table. The first**,** the correlation between accuracy proof and semantic barrier is found -0,486 indicating sufficient level of correlation. However, the negative correlation shows that the correlation between the two variables is opposing each other. This means that the higher the semantic barrier, the weaker the Accuracy proof resulted by the learners. The second, the correlation between accuracy proof on Geometry and syntactic barrier is -0.907. This score indicates strong negative correlation showing that the higher the syntactic obstacle the weaker the accuracy proof arranged by the learners.

Table 14**.** *Correlation between semantic, syntactic, cognitive and pragmatic barriers and accuracy proof*

Correlations

		Proof Accuracy	Semantic Barrier	Syntactic Barrier	Cognitive Barrier	Pragmatic Barrier
Pearson Correlation	Accuracy Proof	1.000	-.486	-.907	-.881	-.745
	Semantic Barrier	-.486	1.000	.529	.512	.595
	Syntactic Barrier	-.907	.529	1.000	.858	.756
	Cognitive Barrier	-.881	.512	.858	1.000	.785
	Pragmatic Barrier	-.745	.595	.756	.785	1.000
Sig. (1-tailed)	Accuracy Proof	.	.003	.000	.000	.000
	Semantic Barrier	.003	.	.001	.002	.000
	Syntactic Barrier	.000	.001	.	.000	.000
	Cognitive Barrier	.000	.002	.000	.	.000
	Pragmatic Barrier	.000	.000	.000	.000	.
N	Accuracy Proof	30	30	30	30	30
	Semantic Barrier	30	30	30	30	30
	Syntactic Barrier	30	30	30	30	30
	Cognitive Barrier	30	30	30	30	30
	Pragmatic Barrier	30	30	30	30	30

The third, the correlation between accuracy proof and cognitive barrier is - 0,881. This score indicates negative strong correlation between the two variables which means that the higher the cognitive barrier the weaker the accuracy proof resulted by the learners. The last is the correlation between the accuracy proof and pragmatic barrier. The result of the computation shows *-0,745* which demonstrates negative strong correlation. This negative correlation means that the higher the pragmatic barrier encountered by the learners, the weaker the accuracy proof which can be performed by the learners.

Then to see how much effect of barriers towards Geometry accuracy proof, Table 15 tells that the score of R square is *0,864* which shows that the Determination Coefficient is *86, 4%.* The score shows that the semantic, syntactic, cognitive, and pragmatic barriers contribute *86, 4 %* to do accuracy of proving arrangement. Meanwhile, the rest *13, 6 %* is determined by other factors as also proved by Noto et.al (2019) that the use of language and mathematical notation are obstacle of pre-service Math teachers on transformation Geometry

Table 15**.** *The effect of semantic, syntactic, cognitive, and pragmatic barriers towards geometry accuracy proof*

Model Summary[b]										
					Change Statistics					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.930[a]	.864	.842	10.719	.864	39.700	4	25	.000	2.480
a. Predictors: (Constant), Pragmatic Barrier, Semantic Barrier, Syntactic Barrier, Cognitive Barrier										
b. Dependent Variable: Proof Accuracy										

Then, to know if the score is significant or not, this can be seen from the result of ANOVA testing which is reported in Table 16 below.

Table 16. *Significant effect of semantic, syntactic, cognitive, and pragmatic barriers towards geometry accuracy proof*

ANOVA[b]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18244.058	4	4561.015	39.700	.000[a]
	Residual	2872.197	25	114.888		
	Total	21116.255	29			
a. Predictors: (Constant), Semantic, Syntactic, Cognitive, and Pragmatic Barriers						
b. Dependent Variable: Accuracy Proof						

The result of the computation of the significant effect shows that the score of Sig. is *0, 00.* It is smaller than *0,05* which indicates the predicted effect is significant and this can be made into a regression equation stating that there is correlation between predictor variables and the independent variable. The significance of the Anova Test can be used to test the feasibility of a regression model with the provisions that a good probability value to be used as a regression model is less than 0.05. Thus, this regression model is very feasible to be used in predicting the proof accuracy.

Subsequently, Table 17 demonstrates that constant values is 95, 126 and the coefficients for each independent variable are x1 (semantic barriers), x2 (syntactic barriers), x3 (pragmatic barriers), x4 (cognitive barriers) respectively 0.42; -0,608; -0,038; -0,421. So that, the form of the regression equation is

$$Y = a_1x_1 + a_2x_2 + a_3x_3 + a_4x_4 + c$$

$$Y = 0{,}42\ x_1 - 0{,}608\ x_2 - 0{,}038\ x_3 - 0{,}0421\ x_4 + 95{,}126$$

These equations indicate that for each increase in the value of x1 by one unit and the value of the other x variables do not change, and then the value of y will increase 0.42 units. For each increase in the value of x2 by one unit and the value of the x other variables do not change, then the value of y will decrease by 0.608 units. Then, for each increase in the value of x3 by one unit and the value of the other x variables do not change, then the value of y will decrease by 0.038 units.

Table 17. *Regression equation on the effect of semantic, syntactic, cognitive, and pragmatic barriers towards geometry accuracy proof*

Coefficients[a]												
	Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations			Co linearity Statistics	
Model	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1(Constant)	95.126	4.990		19.062	.000	84.848	105.404					
Semantic Barrier	.042	.123	.031	.339	.738	-.212	.295	-.486	.068	.025	.631	1.584
Syntactic Barrier	-.608	.159	-.574	-3.831	.001	-.934	-.281	-.907	-.608	-.283	.243	4.122
Cognitive Barrier	-.421	.174	-.381	-2.425	.023	-.778	-.063	-.881	-.436	-.179	.221	4.527

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Pragmatic inhibitions	-.038	.156	-.031	-.240	.812	-.360	.285	-.745	-.048	-.018	.319	3.131

a. Dependent Variable: Keewatin Butte

In addition, for each increase in the value of x4 by one unit and the value of the other x variable do not change, then the value of y will decrease by 0.421 units. This shows that the increasing barrier of syntactic, pragmatic and cognitive can result in the weakness of the result of Geometry proof accuracy. However, the semantic barrier does not correlate to the accuracy proof.

CONCLUSION

This study proves some important notes on the correlation between the semantic, syntactic, pragmatic, and cognitive barriers and the Geometry accuracy proof. The first, the all four barriers have correlation and a significant negative effect with the accuracy of the geometrical proof constructed by students. However, all types of obstacles correlate and significantly influence the accuracy of the evidence when they are tested individually. The second, the average proof accuracy produced by Math students is still in the poor category. Meanwhile, the average successive barriers are respectively cognitive, syntactic, semantic, and pragmatic barriers.

The correlation between the semantic, syntactic, pragmatic, and cognitive barriers with the Geometry proof accuracy is sequentially arranged from the strongest one into correlation between syntactic, cognitive, semantic, and pragmatic barriers to the proof accuracy. Subsequently, the amount of effect of the barriers can be explained that: a) semantic barrier contributes to the proof accuracy for *23,6%* with the regression equation $Y = 67{,}813 - 0{,}643\,x$; b) the syntactic barrier contributes to the proof accuracy for 82.3% with the regression equation can be predicted in the form of equation Y = 91.559 - 0.961x; c) the pragmatic obstacles give effect of 55.5% with the regression equation Y = 77.029 - 0.894x; d) the cognitive barriers have an effect of 77.7% with the regression equation is Y = 93,051 - 0,974x; e) the all four barrier simultaneously give an effect of 84.2% with the regression equation can be predicted in the form of the equation Y = 0.42 x1 - 0.608 x2 - 0.038 x3 - 0.0421 x4 + 95.12–2.

Accordingly, the result of this study can be pedagogically implemented that Math lecturers should consider some possible linguistic barriers which might inhibit the students' achievement in doing Geometry accuracy proof. They should provide their students with correct instructional planning and activities either cognitively or linguistically. Further researchers are suggested to do research on finding out the best way of helping the students proving Geometry accurately.

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