

Chapter 5 Result and Analysis

The results of the data that were collected during the experiment process analyzed into fourth parts. The first part is learning achievement, the second part discusses the correlation between each variable, the third part to explore student learning activities and the fourth part to explore students' perceptions of the Authentic-UG system.

5-1 Analysis of Learning Achievement

Learning achievement analysis uses an descriptive and independent T-test to test the differences in pre-test and post-test between experiment group (EG) and control group (CG), there are four dimensions on learning achievement (post-test), recognizing angle, lines and shape (R), making & measuring angle, line, shape (MM), line and angle estimation (E) and identifying angle, line, and shape properties (I). Table 8 shows descriptive statistical results that demonstrate the experiment group have higher average post-test than pre-test (post-test = 16.0400 and pre-test = 13.7600) and each dimension of the post-test in experiment group (EG) and control group (CG) is higher than their pre-test respectively except recognize line, angle and shape because the post-test in this dimension use authentic image context as the content, so it is more difficult than the pre-test using non-authentic picture.

Table 8. Descriptive statistic of pretest and posttest between two groups

	Group	N	Pre-Test		Post-Test	
			M	SD	M	SD
Recognizing angle, line & shape (R)	EG	25	5.3200	1.02956	4.4400	1.04403
	CG	25	5.0400	.97809	4.5200	1.00499
Making & measuring angle, line, shape (MM)	EG	25	2.0400	.97809	3.6800	2.07605
	CG	25	2.0800	.90921	3.0000	1.44338
Line & angle estimation (E)	EG	25	3.7600	1.42244	4.3600	.56862
	CG	25	3.7600	1.09087	3.5200	.96264
Identifying angle, line, & shape properties (I)	EG	25	2.6400	1.15036	3.5600	.58310
	CG	25	3.0400	1.01980	3.3200	1.14455
Average Score	EG	25	13.7600	3.17910	16.0400	3.07517
	CG	25	13.9200	2.27156	14.3600	2.65957

The independent t-test on Table 9 was conducted to test the difference about pre-test in prior knowledge between control group and experiment group. Its display the all item on pre-test to know the prior knowledge is not significant ($p < 0.05$) difference between experimental

group (EG) and control group (CG). It's indicated that between EG and CG has similar prior knowledge before the experiment and have the same starting point.

Table 9. Independent Sample T-Test for Pre-Test on prior knowledge

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2- tailed)	Mean Difference
R	Equal variances assumed	.215	.645	.573	48	.569	.16000
	Equal variances not assumed			.573	47.638	.569	.16000
MM	Equal variances assumed	.001	.973	-.549	48	.586	-.16000
	Equal variances not assumed			-.549	47.535	.586	-.16000
E	Equal variances assumed	2.188	.146	-.339	48	.736	-.12000
	Equal variances not assumed			-.339	44.241	.736	-.12000
I	Equal variances assumed	.778	.382	-1.566	48	.124	-.48000
	Equal variances not assumed			-1.566	47.247	.124	-.48000
Pre- test	Equal variances assumed	3.099	.085	-.774	48	.443	-.60000
	Equal variances not assumed			-.774	42.859	.443	-.60000

Therefore, we conduct independent t-test to analyze any significant difference in their post-test between control group (CG) and experimental group (EG). The independent t-test of Table 10 shows the results of post-test are significantly different ($p = .044$, $p < .05$) between two groups, furthermore it was found dimension of line and angle estimation (E) reached significant difference between two groups ($p = .001$, $p < .05$). By the result, Authentic-UG system can facilitate student on the experimental group (EG) to learn geometry and to estimate the line and angle on authentic activity.

Table 10. Independent Sample T-Test for Post-Test

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2- tailed)	Mean Difference
R	Equal variances assumed	.015	.902	-.276	48	.784	-.08000
	Equal variances not assumed			-.276	47.930	.784	-.08000
MM	Equal variances assumed	3.416	.071	1.345	48	.185	.68000
	Equal variances not assumed			1.345	42.808	.186	.68000
E	Equal variances assumed	5.081	.029	3.757	48	.000	.84000
	Equal variances not assumed			3.757	38.930	.001	.84000
I	Equal variances assumed	4.849	.032	.934	48	.355	.24000
	Equal variances not assumed			.934	35.672	.356	.24000
Post- test	Equal variances assumed	.162	.689	2.066	48	.044	1.68000
	Equal variances not assumed			2.066	47.022	.044	1.68000

5-2 Correlation Analysis between each Research Variables

The research variables in this study have been described in chapter four which are categorized into three categories, the first is learning behavior include quantity of measurement & quality of measurement, and the second is learning assessment include teacher assessment & peer assessment, and learning achievement (post-test). We conduct Pearson Correlation to show relations between each variable and used Multiple Regression Analysis to investigate the predictions of the strongest potential among research variables that can influence learning achievement (post-test).

5-2-1 Correlation Learning Behavior with Learning Achievement

In the learning behavior, there are two variables the name is quantity of measurement and quality of measurement. Learning behavior based on the quality of measurement on authentic of work divided into two groups, accuracy of line and accuracy of angle. There is any significant correlation between the quantity of measurement to learning achievement (post-test) that shows on Table 11 and significant correlation between the quality of measurement to learning achievement (post-test) that shows on Table 12.

Learning behavior based on the quantity of measurement with learning achievement (post-test) on Table 11 indicates that the quantity of time learning with Authentic-UG application has a significant correlation with the total score of post-test ($r=.399, p=.048$). This finding shows that all topics on learning material on the Authentic-UG can be used to support geometry learning that can improve student's understanding. Student's understanding is specifically indicated by a significant correlation on the dimension of line and angle estimation ($r=.580, p=.002$), which means that students can estimate the length of the line and degree of the angle after reading the material because in each material have various examples of geometry type on images.

Table 11. Correlation between learning behavior based on quantity of measurement with learning achievement (post-test)

	1	2	3	4	5
1. Number of Records	1				
2. Total Time Making Records	.572**	1			
3. Total Time Learning	.439*	.399*	1		
4. Total Step with Pedometer	.442*	.494*	.144	1	
5. Total Trying Making Records	.554**	.475*	.023	.533**	1
6. Recognizing angle, line, & shape (R)	.355	.195	.317	.154	.193
7. Making & measuring angle, line, shape (MM)	.124	.111	.210	.165	.026
8. Line & angle estimation (E)	.395	.303	.580**	.182	.050
9. Identifying angle, line, & shape properties (I)	.027	.219	.225	.039	.207
10. Total score post-test	.282	.238	.399*	.205	.132

Learning behavior based on the quality of measurement with learning achievement (post-test) on Table 12 indicates that overall the quality of measurement on each topic (see Appendix 3) have any significant correlation on the overall total post-test, especially in the dimension of line and angle estimation (E) which means that student have estimation skills

can be used to predict the type of angle based on the estimation of existing authentic objects. Estimation skill is very important when doing authentic activities because students must be able to solve authentic problems with the actual size. In addition, in the dimension of making & measuring angle, line, shape (MM), it's shows a significant correlation which means that students also learn to making real measurements on lines ($r=.473$, $p=.017$) and make angles ($r=.438$, $p=.029$) especially on the combine topic because there are two concepts, the concept of line segment and concept of angle with two different types, such as complementary angle to combine two angles up to 90 degrees and supplementary to combine two angles up to 180 degrees use direct measuring on authentic geometry objects. Quality of measurement on annotation also have correlation with learning achievement (post-test) because annotation can provide clear explanation on authentic learning that show in Figure 11.

Table 12. Correlation between learning behavior based on quality of measurement with learning achievement (post-test)

	1	2	3	4	5	6	7	8	9	10
1. Annotation	1									
2. Accuracy of line on line segment topic	.058	1								
3. Accuracy of line on angle topic	.206	.467*	1							
4. Accuracy of line on combine topic	.354	.500*	.263	1						
5. Accuracy of line on triangle topic	-.018	.519**	.293	.121	1					
6. Accuracy of line on quadrilateral topic	.210	.004	.155	.163	.378	1				
7. Accuracy of angle on angle topic	.218	.485*	.452*	.309	.452*	.242	1			
8. Accuracy of angle on combine topic	.499*	.535**	.551**	.318	.556**	.353	.386	1		
9. Accuracy of angle on triangle topic	.373	.217	.328	.069	.398*	.263	.537**	.467*	1	
10. Accuracy of angle on quadrilateral topic	.443*	.149	.209	-.061	.144	.356	.220	.580**	.557**	1
11. Recognizing angle, line, & shape (R)	.241	.032	.339	.049	.321	.379	.220	.316	.259	.258
12. Making & measuring angle, line, shape (MM)	.351	.160	.193	.473*	.274	.281	.201	.438*	.277	.277
13. Line and angle estimation (E)	.442*	.416*	.477*	.397*	.404*	.429*	.601**	.678**	.507**	.506**
14. Identifying angle, line, & shape properties (I)	.129	.243	.388	.307	.325	.177	.394	.256	.185	.178
15. Total score post-test	.425*	.242	.408*	.468*	.430*	.431*	.396*	.576**	.404*	.402*

5-2-2 Correlation Learning Assessment with Learning Achievement

The learning assessment has two types, learning assessment based on peer assessment and based on teacher assessment. Learning assessment based on peer assessment, that students provide comment with fill the note and give some annotations, and also providing assessment use scaffolding assistance with three multiple representation questions for peer score in the linguistic, logical and visual domains to help students provide assessment for their peer because the student is too young if they want to provide an assessment to their peer. The results of the peer assessment can be seen directly by them self and their peers through the Authentic-UG application and the teacher can also see the interaction of peer assessment through on the Dashboard-UG. Learning assessment based on teacher assessment, the teacher provides an assessment of the authentic task results using a score of 0 to 5 based on the teacher assessment scaffolding including accuracy of the authentic results and the correctness of authentic object.

Table 13 shows the teacher assessment and peer assessment with three dimensions of scaffolding have a significant correlation with the overall total post-test which means that the teacher assessment and peer assessment can provide a major influence to evaluate the overall records of authentic work.

In addition to the overall of post-test, there is a significant correlation in the dimensions of making & measuring angle, line, shape (MM), which means that each result of making and measuring will be evaluated properly by the teacher and other students with the same assessment value. Students make authentic tasks using the Authentic-UG system to searching for objects on surrounding and then make sure that the authentic object was created has a correct size that matches the problem-based question. If the result not in same with the level of accuracy, the student can try again to repeat making of authentic task until have correct an authentic work. The process of making the authentic task and measurement, makes students encourage to want to try for ensuring that authentic object that made was correct to their concept on each topic, this is also reflected in the results of the post-test because students can learn about the kind of different line, angle, and shape from geometry that show in Appendix 1.

Teacher assessment and peer assessment also have significant correlation on the dimension of making & measuring angle, line, shape (MM) and dimension of line and angle estimation (E), because using accuracy on the system, the teacher and other students also have

to check the results of authentic work comprehensively before they give assessment that show in Appendix 2.

Table 13. Correlation learning assessment with learning achievement (post-test)

	1	2	3	4
1. Peer Assessment on Linguistic	1			
2. Peer Assessment on Logical	.643**	1		
3. Peer Assessment on Visual	.598**	.242	1	
4. Teacher Assessment	.490*	.632**	.453*	1
5. Recognizing angle, line, & shape (R)	.068	.215	.125	.224
6. Making & measuring angle, line, shape (MM)	.422*	.462*	.411*	.400*
7. Line & angle estimation (E)	.554**	.592**	.446*	.795**
8. Identifying angle, line, & shape properties (I)	.218	.228	.310	.387
9. Total score post-test	.452*	.538**	.462*	.567**

5-3 Correlation Learning Behavior with Learning Assessment

Authentic of work or student's records separated to three different location that shows on Figure 17 with map clustering and separated into each learning material shows on Table 14.

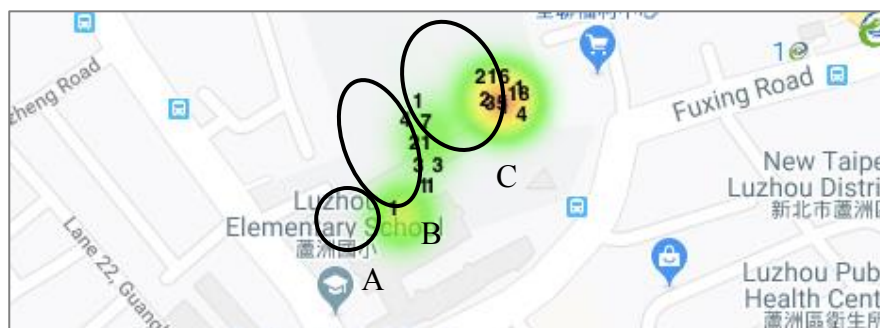


Figure 17. Location of authentic work with map clustering

Table 14. The location authentic of work on each topic

	Line	Angle	Combine	Triangle	Quadrilateral
Corridor near classroom (A)	40	1	0	2	0
Basketball court (B)	5	1	0	0	42
Sport field (C)	2	83	36	75	3

Table 14 shows the student's authentic at different learning material and different location because student explored the authentic object go to location. Some location that show on Appendix 9 has authentic object-based questions and some location does not provide

clearly the authentic object. More students are doing authentic on the Sport field (C) because in that place there are many geometric objects such as pedestal-shaped triangular, pedestal-shaped quadrilateral, lumber, table, and chairs that are suitable for problem-solving problems, and then the Corridor near classroom (A) there are many straight line objects that match to line topics while in Basketball court (B) students look for geometry objects on the track line.

5-3-1 Correlation Quantity of Measurement in Learning Behavior with Learning Assessment

The analysis also indicates the correlation between the quantity of measurements with the teacher assessment and peer assessment that was found in Table 15. The analysis shows the teacher assessment has a significant correlation with the amount of time to make authentic of work ($r=.520$, $p=.008$) and the length of time to study ($r=.682$, $p=.000$) because the more learning to create of authentic work, the more teachers will also make an assessment too. That is also the peer assessment especially in the logical dimension which has similar significance to the number authentic of work ($r=.504$, $p=.010$), the total time to make authentic of work ($r=.398$, $p=.049$) and the length of time spent studying ($r=.548$, $p=.005$). Furthermore, the peer assessment has a significant correlation on the linguistic dimension ($r=.396$, $p=.050$) and the visual dimension ($r=.581$, $p=.002$) with the total step on pedometer, because when looking for an authentic object, students will create more the results of authentic and adjust the explanations that will be written with annotation, but we will further investigation in the future, about effect the quality and quality to learning assessment.

Table 15. Correlation Quantity of Measurement with Learning Assessment

	1	2	3	4	5
1. Number of Records	1				
2. Total Time Making Records	.572**	1			
3. Total Time Learning	.439*	.399*	1		
4. Total Step with Pedometer	.442*	.494*	.144	1	
5. Total Trying Making Records	.554**	.475*	.023	.533**	1
6. Teacher Assessment	.396	.520**	.682**	.152	-.060
7. Peer Assessment on Linguistic	.245	.167	.581**	.396*	.055
8. Peer Assessment on Logical	.504*	.398*	.548**	.011	.032
9. Peer Assessment on Visual	.251	.278	.334	.581**	.360

5-3-2 Correlation Quality of Measurement in Learning Behavior with Learning

Assessment

The quality of measurement has two types that accuracy of angle and accuracy of line has a correlation with learning assessment based on teacher assessment shown in Table 16. The result of correlation analysis showed that on accuracy of line on the combine topic ($r = .441, p = .027$) and accuracy of line on the combine topic ($r = .399, p = .048$) there was significance with overall teacher assessment, it shows that the result of quality measurement on the combine topic will have a large impact on the teacher's assessment. However, in detail, it can also be seen in the item of teacher assessment have significance with accuracy of line on angle topic, accuracy of line on combine topic, accuracy of line on triangle topic, and especially on accuracy of angle on combine topic. Its mean that angle is important as the creation of authentic of work which will be assessed by the teacher. Teacher assessment is very important which show most correlate than peer assessment, because teacher as expert than student.

Table 16. Correlation Quality of Measurement with Learning Assessment

	1	2	3	4	5	6	7	8	9	10
1. Annotation	1									
2. Accuracy of line on line segment topic	.058	1								
3. Accuracy of line on angle topic	.206	.467*	1							
4. Accuracy of line on combine topic	.354	.500*	.263	1						
5. Accuracy of line on triangle topic	-.018	.519**	.293	.121	1					
6. Accuracy of line on quadrilateral topic	.210	.004	.155	.163	.378	1				
7. Accuracy of angle on angle topic	.218	.485*	.452*	.309	.452*	.242	1			
8. Accuracy of angle on combine topic	.499*	.535**	.551**	.318	.556**	.353	.386	1		
9. Accuracy of angle on triangle topic	.373	.217	.328	.069	.398*	.263	.537**	.467*	1	
10. Accuracy of angle on quadrilateral topic	.443*	.149	.209	-.061	.144	.356	.220	.580**	.557**	1
11. Teacher Assessment	.297	.454*	.455*	.513**	.412*	.169	.651**	.647**	.369	.231
12. Peer Assessment on Linguistic	.389	.064	-.021	.417*	.008	.297	.217	.241	.066	.265
13. Peer Assessment on Logical	.215	.184	.442	.441*	.316	.438	.361	.399*	.090	.073
14. Peer Assessment on Visual	.376	.064	.011	.059	.180	-.033	.269	.328	.319	.304

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

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

There is a difference between the assessment using the quality of accuracy from authentic-UG with the teacher assessment or peer assessment. The quality of accuracy from measurements obtained through algorithm calculations from the system, while for assessments from teacher or peer using multiple representations with three dimensions, such as the way students explain the answers (linguistic), the student makes a measurement or reasoning the estimation (logical) and mathematical symbol representations (visual).

Table 17 shows that teacher assessment has a significant correlation to peer assessment such as peer assessment on linguistics ($r = .490$, $p = .013$), peer assessment on logical ($r = .632$, $p = .001$), and peer assessment on visual ($r = .453$, $p = .023$) which indicates that the peer assessment has the same teacher's assessment and the peer has the same capability to evaluate authentic work.

Table 17. Correlation between teacher assessment and peer assessment

	1
1. Teacher Assessment	1
2. Peer Assessment on Linguistic	.490*
3. Peer Assessment on Logical	.632**
4. Peer Assessment on Visual	.453*

Multiple regression analysis with the step-wise method was used to determine the predictor of variables that have a major influence on student learning achievement (post-test). Table 18 indicate there are two models that affect student learning achievement, the first model is the accuracy of angle on combine topic and then the second model including accuracy of angle on combine topic and peer assessment on logical has a greater influence on the first model. In line with this, the R-value is .667 (67%) shows that student learning achievement has a strong relationship with accuracy of angle on combine topic and peer assessment on logical.

Table 18. Multiple Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.576 ^a	.332	.303	2.56687
2	.667 ^b	.445	.394	2.39292

a. Predictors: (Constant), Accuracy of angle on combine topic

b. Predictors: (Constant), Accuracy of angle on combine topic, Peer Assessment on Logical

There are two models predicted to influence the variables in this study shows in Table 19. The accuracy of angle on combine topic is significantly predicted to post-test on the first model and peer assessment on logical with the accuracy of angle on combine topic on second model is predicted to learning achievement (post-test). The result consists most significant in Table 20 using ANOVA. Peer assessment on logical is very influential because students can compare the work results with the accuracy result that displayed on the system to make sure that angle and line are correct and accuracy angle is more important or equal to mathematical representation because combining the concept of angle makes students have to be able to have a good concept to make an angle, after that the students were able to know the type of angle combination such as complementary angle and supplementary angle. Therefore, scaffolding can work well to help peer assessment quality, also combine topic is important to help estimation ability to predict the post-test.

Table 19. Multiple Regression Coefficient

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	6.142	2.970		2.068	.050
Accuracy of angle on combine topic	.140	.042	.576	3.383	.003
2 (Constant)	6.442	2.773		2.323	.030
Accuracy of angle on combine topic	.105	.042	.431	2.486	.021
Peer Assessment on Logical	1.378	.652	.366	2.113	.046

a. Dependent Variable: Total Score Post-Test

Table 20. Multiple Regression ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	75.418	1	75.418	11.446	.003 ^b
Residual	151.542	23	6.589		
Total	226.960	24			
2 Regression	100.987	2	50.493	8.818	.002 ^c
Residual	125.973	22	5.726		
Total	226.960	24			

a. Dependent Variable: Total Score Post-Test

b. Predictors: (Constant), Accuracy of angle on combine topic

c. Predictors: (Constant), Accuracy of angle on combine topic, Peer Assessment on Logical

After detailing the many correlations above, it can be summarized in Figure 18. which shows the architecture variable by showing the correlation results on each variable. In learning behavior and learning assessment has a correlation with learning achievement (post-test).

In the learning behavior shows that quantity on total time learning has correlation with the total post-test and the overall quality of measurement has a correlation with the total post-test, especially in the dimension of line & angle estimation (E). The combine topic on quality of measurement also correlates with dimensions of making & measuring angle, line, shape (MM) and the annotations also have a correlation with the total Post-Test, especially in the line & angle estimation dimension (E).

The learning assessment showed that the overall dimensions of the peer assessment had a correlation with the total post-test as well as the teacher assessment which correlated with total post-test. In peer assessment and teacher assessment also correlation to the dimensions of making & measuring the angle, line, shape (MM) and on the dimensions of line and angle estimation (E). The important correlation shows with orange and green color, because can impact two groups that show before on Table 10 about Independent Sample T-Test for Post-Test.

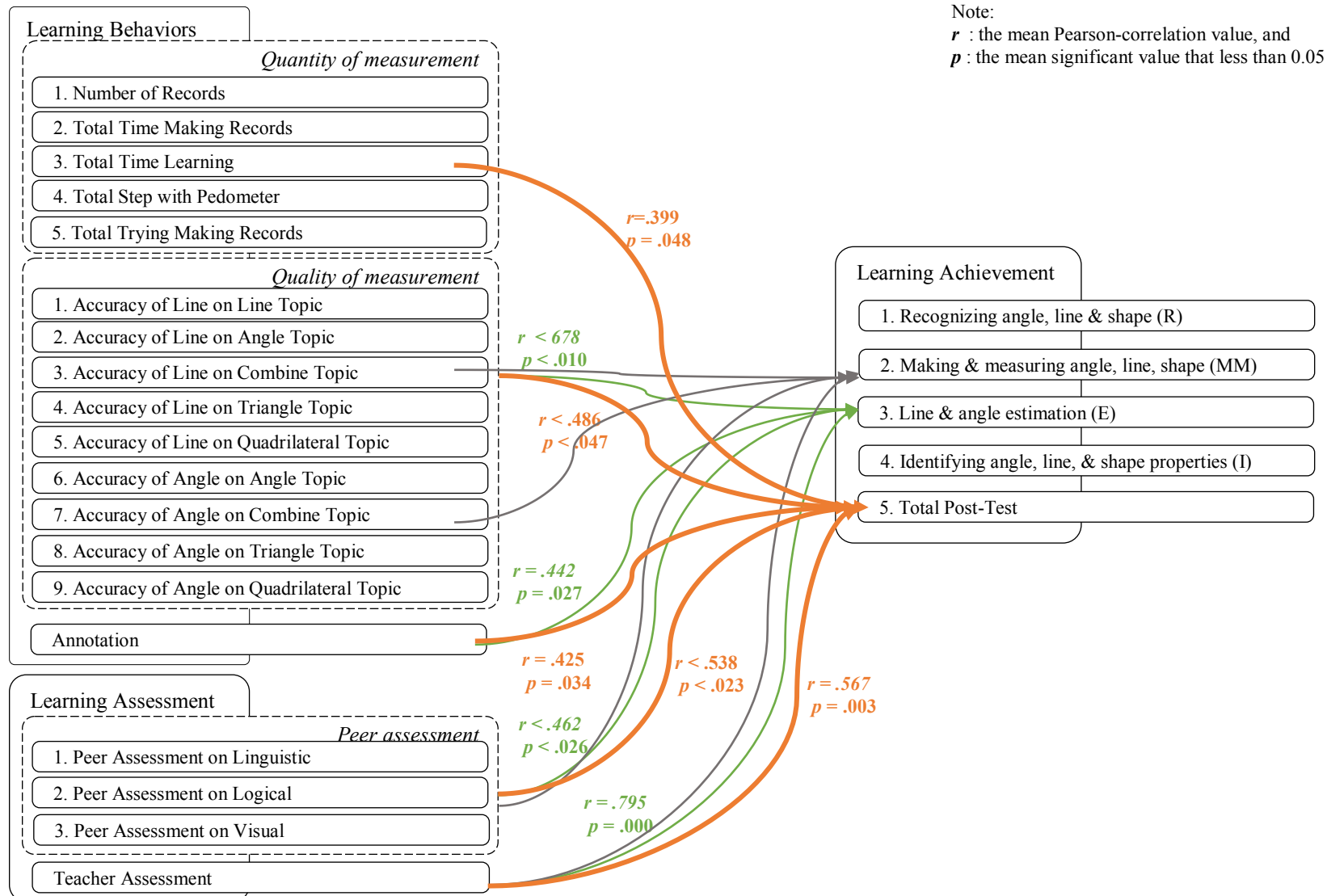


Figure 18. Correlation each variable to post-test

5-4 Lag-Sequential Analysis of Learning Activities when using Authentic-UG

In the learning behavior context, the details of students' activities at the Authentic-UG for applying authentic problem can be seen using the video recordings that produced by the system, but we also analyze the sequence of activities of students using Lag-Sequential Analysis (LSA). The sequence of activities in the Authentic-UG divided into five steps, the first step to read & understand the material, the second step to find & create authentic objects based on authentic problems in question, the third step to provide notes that contain descriptions of the objects made, the fourth step to provide annotations to facilitate visual understanding and the last step is to send to the system peer assessment and teacher assessment and the student can continue to same topic or change to another topic. The following are the results adjusted R-Squared from Lag-Sequential Analysis (LSA) show in Figure 19.

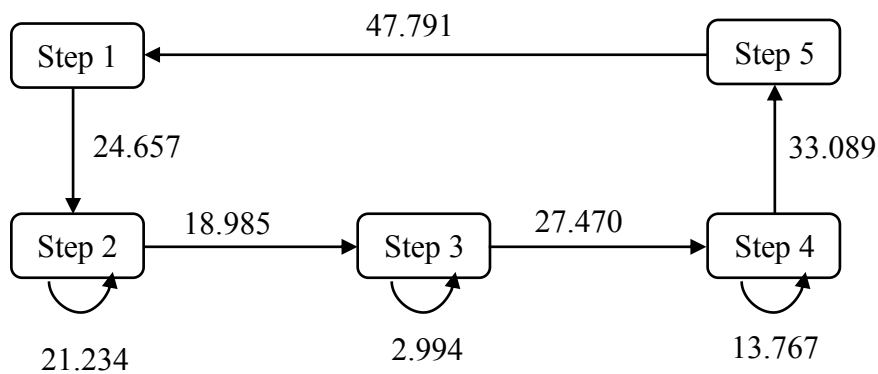


Figure 19. The Model from Lag-Sequential Analysis (LSA) result

Figure 19 shows the sequence of the first step until the fifth step has an interconnected sequence. In step 2, there is a repetition (21.234) because in the second step students are making authentic of work according to the problem problems they get, then for the third step there is also a repetition (2.994) because at this step students try to provide narrative explanations that are in equal with authentic results of work that have been made and on the fourth step there is also a repetition (13.767) because in this stage students make various annotations on the authentic of work results such as making angular symbols or numbers, and finally for the fifth step will go to the first step (47.791) because after students have completed authentic of work, students can do authentic activities learning for other topics or on the same topic.

5-5 Student Perceptions of Authentic-UG System

Student perception on Authentic-UG system with three questionnaires, such as: TAM, ARCS, and Authentic Learning Questionnaire for applying authentic activity using Authentic-UG. There are 12 questions in the questionnaire TAM which include perceived usefulness, perceived ease of use, behavioral intention to use and attitude toward use. The ARCS questionnaire there are 14 questions which included attention, relevance, confidence and satisfaction. The Authentic Learning questionnaire there are 19 questions which included learning by applying, healthy learning, collaborative learning, creativity, sustainability, and scalability. Both questionnaires used a Likert scale 1-5 and Cronbach's Alpha testing was carried out to test the level of validity and consistency of the survey, Cronbach's Alpha results on the TAM questionnaire are shown in Table 21 with high reliable results ($\alpha = .892$) and the results of the ARCS questionnaire shown in Tables 23 with high reliable results ($\alpha = .852$). The results of the descriptive analysis of TAM shown in Table 22 show that in total it has been able to help students in learning geometry in the context of authentic learning.

Table 21. Reliability analysis of TAM Questionnaire

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.892	.897	12

Table 22. Descriptive analysis of TAM

Dimension	Item on Questionnaire	Mean	Std. Deviation
Perceived Usefulness	1-3	3.31	1.02
Perceived Ease of Use	4-6	3.27	1.13
Attitude Toward Use	7-9	3.60	1.02
Behavioural Intention	10-11	3.28	1.12

The descriptive mean results of the ARC descriptive analysis shown in Table 24 are almost the same as TAM. The mean for each dimension shows a mean range of 3 to 4, when referring to the score interpretation table, Authentic-UG media can help students to learn geometry at a moderate high level.

Table 23. Reliability analysis of ARCS Questionnaire

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.852	.854	14

Table 24. Descriptive analysis of ARCS

Dimension	Item on Questionnaire	Mean	Std. Deviation
Attention	1-4	3.45	1.15
Relevance	5-8	3.38	1.09
Confidence	9-11	3.33	1.00
Satisfaction	12-14	3.58	0.94

In addition, we also used an authentic learning questionnaire with a very high level of Cronbach's Alpha reliability ($\alpha = .953$) in Table 25.

Table 25. Reliability analysis of Authentic Learning Questionnaire

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.953	.953	19

The results of the descriptive analysis in Table 26 based on authentic learning questionnaire showed that the level of sustainability of Authentic-UG use was very high (3.84) because students were happy to use Authentic-UG and students have high motivation, similar to the TAM analysis. Students also feel that they have meaning from collaborative learning (3.74) because the learning system uses authentic learning to look for geometry objects around them (3.67) that they explore solutions to the problem of authentic like creatively (3.68). In the end, it will make students feel healthy (3.63) because, in authentic learning, students can freely and active to explore the environment around them.

Table 26. Descriptive analysis of Authentic Learning Questionnaire

No	Statement	Mean	Std Deviation
Learning by Applying			
1	I relate the concepts of Angle and Polygon with my surrounding using Authentic-UG app.	3.67	1.18
2	I use Authentic-UG to get more understanding of the concepts of Angle and Polygon.		
3	Using Authentic-UG can help me to identify geometry objects in my surrounding.		
4	Using Authentic-UG to explore geometry objects in my surrounding can give me a happy learning experience.		
5	Using Authentic-UG to apply the concepts of Angle and Polygon		

in my surroundings can help me to get more useful knowledge.

Healthy Learning			
6	Walking regularly to measure angles and lengths of geometry objects in my surroundings using Authentic-UG app can strengthen my bones and muscles.		
7	Sensing the fresh air when I explore different geometry objects in my surroundings using Authentic-UG app makes feel better.	3.63	1.10
8	I think to walk to explore different geometry objects in my surroundings using Authentic-UG app can make me healthier.		
9	I always have a cheerful effect on others when I explore geometry objects in my surrounding using Authentic-UG app.		
Collaborative Learning			
10	I can enhance my knowledge in the discussions learning activity by using Authentic-UG app.		
11	My peers can share their experiences and knowledge with me by using Authentic-UG app.	3.74	1.09
Creativity			
12	I can manipulate the geometry object to measure the angles and lengths using Authentic-UG app.		
13	My imagination of geometry objects can be realized by measuring the angles and lengths using Authentic-UG app.	3.68	1.13
Sustainability			
14	Applying Angle and Polygon concepts in my surrounding can motivate me to learn more.		
15	I like to measures geometry objects in many different topics by using Authentic-UG app.	3.84	1.04
16	Using Authentic-UG app to solve geometry problems in my surroundings can help me to remember related previous knowledge.		
Scalability			
17	I will suggest others to use Authentic-UG app to explore geometry objects in their surroundings.		
18	I will do more measurements using Authentic-UG app to improve my understanding of geometry concepts in my surrounding.	3.68	1.05
19	I will do more measurements using Authentic-UG app to get familiar with geometry objects in my surrounding.		

In addition, students feel happy learning experience and have the motivation to learn on different topics to make measurements in the authentic environment that can help remember related previous knowledge. The authentic learning process also makes students able to learn

collaboratively because they can share experiences or do discussions. Students also feel more creative after making measurements of angle and measurement of the line because students must be able to imagine and manipulate geometric objects. Students feel that will use Authentic-UG to measurements was recommend to others to learn geometry in order to understand the concept by estimation geometry objects in an authentic environment. Not only that, Authentic-UG can also make students feel healthier because students do an exploration of the authentic environment to solve problems by finding suitable geometric objects.

We also conducted interviews to students with the questions can see on Appendix 8, and the following interview results, such as:

- a) The most students like evaluate (70%) and add the comment (37,5%) to friends works because students can show own work and peer work to make the comparison.
- b) 58% students agree that peer assessment is helpful and 62% student feels satisfied the comment from their peer.
- c) 41.6% students think that their peer assessment is fair, 45.8% is not known, and 12.5% is not fair on peer assessment.
- d) Students did not feel depressed but student feels confident to make comment (54%), confident to add the comment to their peer (62.5%) on peer assessment.
- e) 70.8% student like Authentic-UG app, especially on the ranking page
- f) 75% student think the use of real objects to measure the angle will make you a better understanding of "Angle" and "Polygon" because with the real object can better understand, feel fun, more familiar and like a new experience
- g) 66% student think the annotation function is very important because can describe the related content and make easier to understand the real object