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The Effectiveness of the CIRC Learning Model in terms of Self Confidence and Mathematical Generalization Ability

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Abstrak. This study aims to find out that the Cooperative Integrated Reading and Composition (CIRC) learning model is effective against self-confindence and mathematical generalist abilities of students in the material and ranks of class X TKJ SMK Mutiara Mayong. The population in this study were all students of class X TKJ SMK Mutiara Mayong. The sample of this study was class X TKJ 2 and X TKJ 3 which were randomly selected from three classes, each of which had 27, 18 and 23 students. The instrument used to collect data was a mathematical generalization ability test in the form of 5 problem descriptions and a self-confidence questionnaire consisting of 38 questions. Testing the effectiveness of Cooperative Integrated Reading and Composition (CIRC) learning models is carried out with a one sample t-test to determine whether there is an increase in students' generalization and self-confidence abilities between experimental classes before and after treatment is given. Meanwhile, to test whether there are differences in mathematical generalization abilities and students' self-confidence between the experimental class and the control class, a t-independent test is performed. The results showed that (1) effective Cooperative Integrated Reading and Composition (CIRC) learning model in terms of students 'self-confidence, (2) Cooperative Integrated Reading and Composition (CIRC) learning model effectively in terms of students' generalization abilities.

Key words: CIRC, mathematical generalist ability, self confidence

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INTRODUCTION

Mathematics is part of science that makes a real contribution to the development of science and at the same time the development of human resources. Lesmana *et al* (2018, p.864) mentions that one of the goals of education is that students can use reasoning on patterns and properties, perform mathematical manipulations in making generalizations, compile evidence, or explain mathematical ideas and statements. In fact, these goals have not been realized.

The Secretary's Commission on Achieving Necessary Skills in the year of 1990 (Cahyono, 2017, p.52) states that the competence of critical thinking, making decisions, problem-solving, and reasoning is something that is important in work performance. While generalist ability is the development of reasoning ability. While generalist ability is the development of reasoning ability. The ability to generalize is an activity that is classified as inductive reasoning and is an important aspect of the thinking process (Lesmana, Hidayat dan Rohaeti, 2018, p. 864; Shadiq, 2014, p.17; Aprilita, 2016, p.2).

In Indonesia itself, students' reasoning abilities are still relatively low. Report *The Trends in International Mathematic and Science Study* in 2011 (Aprilita, 2016, p.2) shows that the passing percentage of Indonesian students' mathematical abilities, especially in reasoning abilities, is only able to reach 17%, while this percentage is very far below the international average passing percentage of 30%. Keterampilan berpikir siswa akan meningkat setelah mengikuti pembelajaran matematika karena pola pikir yang dikembangkan dalam pembelajaran matematika melibatkan pemikiran kritis, sistematis, logis dan kreatif. Generalist ability supports students to draw conclusions from various facts or data that they get or know. So that generalist abilities are important for students to have and good generalist abilities will result in good work or study performance as well.

Hudojo (Aprilita, 2012, p.2) mentions that thinking mathematically is a mental activity in the process of using generalizations. Students' mistakes in using generalizations can cause difficulties for students to find mathematical concepts properly. So that the ability to

generalize mathematics is a mathematical thinking process that is the basic capital in understanding mathematical concepts. Thus, mathematical generalizations need to be trained by teachers to students. The ability to generalize itself can be developed and trained through material related to patterns, one of which is material about sequences and series. Observing patterns can challenge students to use their generalization abilities. Rahman (Aprilita, 2016, p.3) mentions the ability to generalize mathematics has three aspects namely *perception of generality, expression of generality and symbolic expression of generality*.

Based on the results of observations and interviews with one of the mathematics teachers at Mutiara Mayong Vocational School, it can be concluded that students have not been able to explain mathematical ideas and statements. This resulted in students having difficulty finding good mathematical concepts. In addition, when students are faced with patterned questions, students have difficulty identifying questions both in expressing questions into numerical and verbal mathematical models, students also experience confusion in using the results of their identification to solve problems. So it can be concluded that the generalist ability of students at Mutiara Mayong Vocational School is still low. In addition to the low generalist ability, the mathematics teacher also added other problems experienced by students in learning activities. Some of the problems experienced by students include that most students solving questions are done in groups, even though the questions presented are independent types of questions. In addition, students look anxious when working on math problems, nervous when asked to come to the front of the class, and leave questions that are considered difficult. So that it can be concluded from the conditions described above, it shows that the self-confidence ability at Mutiara Mayong Vocational School is also still relatively low.

Based on the results of observations, learning in the teacher's class still uses conventional learning methods, namely using the expository method. Where the lecture method makes learning focused in one direction from teacher to student (teachers center). This makes students' self-confidence abilities and mathematical generalist abilities low, as indicated by the results of the questionnaire. The self-confidence questionnaire score before being given treatment was 112.9 and the average test for students' initial mathematical generalist ability was 69.39. Even though having high self-confidence will support students to be able to socialize well. Hendriana et al (2014, p.3) mentions someone who has strong self-confidence will be motivated to achieve success. So that student self-confidence is needed so that students are able to generalize a concept.

Mathematical generalist ability (Lestari, 2015, p.89) is the ability to perceive (state patterns), determine structures, data, images, or the next term, and formulate generalities symbolically. In line with Tall's opinion (Aminah, et al, 2018, p.48) which states that the term "generalization" is used in mathematics to indicate the process in which concepts are seen in a wider context and also the results of that process. Fitriani (2016, p. 10) also states that mathematical generalist ability is the ability of students to the reason which aims to draw a conclusion based on the underlying facts. Based on these understandings it can be concluded that mathematical generalist ability is the ability to process conclusions based on facts from specific circumstances to generally relate to certain patterns or rules.

Indicators of mathematical generalization ability (Rahman, 2004, p.14; Aprilita, 2016, p.2) are the perception of generality, expression of generality, and symbolic expression of generality. In addition, Mason (Harry, 2013, p.14; Bidari, 2016, p.27) states that indicators of mathematical generalist ability consist of perception of generality, expression of generality, symbolic expression of generality, and manipulation of generality. So it can be concluded that there are four indicators of mathematical generalist abilities, namely: perception of generality (knowing rules), expression of generality (describing rules), symbolic expression of generality (generating rules), and manipulation of generality (using generalization results to solve problems). In addition to mathematical generalist abilities, students must also have self-confidence. According to Lestari and Yudhanegara (2015, p.95) self-confidence is an attitude of confidence in one's own abilities and seeing oneself as a whole person with reference to self-concept. By believing in their own abilities, of course, students will get used to being independent in doing anything, including working on math problems.

Aspects of students' self-confidence

according to Lauster are self-confidence, optimism, objectivity, responsibility, rationality, and realistic (Zamnah et al, 2018, p.53; Ghufron and Rini, 2011). According to Walgio (Purwasih, 2015, p.19) one of the ways to foster self-confidence is to provide a democratic atmosphere or condition, namely, individuals are trained to be able to express opinions to other parties through social interaction, trained to think independently and are given a safe atmosphere so that individuals not afraid to do wrong. Recognizing the importance of students' mathematical generalist abilities and self-confidence, we need a learning plan that must be designed to be able to combine reading activities with other activities, such as writing, discussions, and presentations in an integrated manner. This is done so that learning is not monotonous and that students are expected to be interested and feel comfortable in learning activities.

Andriani et al (2014, p.236) revealed that the CIRC learning model is a model that requires students to work together to read to each other, find keywords, provide responses to discourse then write down on sheets of paper. Students interact with each other and communicate findings so as to increase student self-confidence. Student Worksheets (LKPD) contain problems in everyday life related to sequences and series material so that students feel interested in participating in learning. The problems given are in the form of contextual word problems, in which students must manipulate the questions into mathematical forms so that they can improve students mathematical generalist abilities.

Jenisa and Lubis (2016, p.78) mention that type CIRC cooperative learning in terms of language can be interpreted as a cooperative learning model that integrates a reading as a whole and then composes it into important parts. This type of CIRC cooperative learning model is expected to further motivate students to interact and explore existing learning materials, help each other, and discuss and argue with their ideas. Calderon (Ristanto et al, 2018, p.51) says the CIRC learning model has three principal elements, namely: the relationship between basic activities, direct regularity in understanding reading, and integration between language arts and writing. Broadly speaking, the CIRC learning steps are (1) Partner Reading: The teacher divides students into several groups; (2) Story Structure and Related Writing: The teacher provides material that students and LKPD must understand; (3) Word Out Loud: students discuss with each other conveying their ideas (thoughts); (4) Word Meaning: students conclude solutions from the ideas presented during discussions and write them on LKPD; (5) Story re-tell: student presentations; (6) Reflection: reflection with the teacher. Related to the explanation that has been done, this study aims to describe the effectiveness of the CIRC learning model in terms of self-confidence and the effectiveness of the CIRC learning model in terms of students' mathematical generalization abilities.

METHODS

The method used is a quasi-experimental method with a pretest-posttest design. The research was conducted at Mutiara Mayong Vocational School for the 2018/2019 academic year from January to March 2019. The population in this study was all class X TKJ at Mutiara Mayong Vocational School, consisting of three classes, namely: X TKJ 1, X TKJ 2, and X TKJ 3. Two classes were randomly selected to be used as research samples. Next, two classes were randomized, selecting class X TKJ 2 as the experimental class and class X TKJ 3 as the control class. The experimental class was given the CIRC learning model and the control class was given the conventional expository learning model. The number of students in the experimental class was 18 students, while in the control class there were 23 students.

Research data collection was carried out by giving a pretest test before the class was given treatment, which consisted of a test describing mathematical generalist abilities and a self-confidence questionnaire. Mathematical generalization ability is limited to the matter of sequences and series. The pretest was carried out to see the students' initial abilities. Then given treatment in the form of a CIRC learning model. Furthermore, posttest questions were given in the form of tests of mathematical generalist abilities and student self-confidence questionnaires. The instruments used to collect data were an initial ability test of mathematical generalization consisting of five description questions and a self-confidence questionnaire consisting of 38 questions with five scales. Before the test instrument was used, a trial test was carried out in class XII PS SMK Mutiara Mayong which was then tested for validation, reliability, discriminating power, and level of difficulty. Meanwhile, the questionnaire was

only tested for validity and reliability. The results of the reliability analysis of the research instrument were as follows:

Table 1. Instrument Reliability Results

Instrument	Reliability	Standard Deviation	
	Post	Pre	Post
Generalization ability	0.73	15.44	7.91
Self Confidence	0.94	3.82	6.41

Based on Table 1, it can be seen that all the instruments used in the study have a reliability coefficient above 0.70. Thus, it can be concluded that the test and questionnaire instruments in this study are reliable.

Descriptive analysis was used to describe the data obtained through the results of the pretest and posttest of mathematical generalist abilities and self-confidence. The description is done by looking for the average value, maximum value, minimum value, standard deviation, and completeness of the data obtained. In addition to descriptive analysis, inferential analysis was also carried out. Before carrying out the analysis, tests were carried out both before and after being given treatment. The normality test uses the Liliefors test, with class decision criteria said to be normal if $L_{hitung} < L_{tabel}$ with a significant level of 5%. Furthermore, to determine class homogeneity before being given treatment, the Bartlett test was carried out. The decision to test and conclude the hypothesis is carried out at a significance level of 5%. Meanwhile, to find out the homogeneity of the class after being given treatment, the F test was carried out. The test decisions and conclusions were carried out at a significant level of 5%.

An ANOVA test was carried out on the data before being given treatment to see if there were differences in initial abilities between the three classes with the steps (Lestari and Yudhanegera, 2005, p. 295) as follows:

Determine the formulation of the hypothesis

$H_0 : \mu_1 = \mu_2 = \mu_3$ (there is no difference in the generalist abilities of students in the three classes)

H_1 : one is μ not the same.

Determine the significant level $\alpha = 5\%$

Determine the statistical test value

Determine the critical value

$F_{tabel} = F_{(\alpha)(dk_A, dk_D)}$

Determine the testing criteria

if $F_{hitung} \geq F_{tabel}$ so H_0 rejected.

if $F_{hitung} < F_{tabel}$ so H_0 accepted.

Make conclusions

The effectiveness of the learning model is determined based on the index of effectiveness in each aspect that is measured. The application of learning using the CIRC learning model is said to be effective if, on student achievement, the average student score reaches more than or equal to 75; if on students' mathematical generalist abilities, the average score reaches 69.39; and if on self-confidence, the average score reaches less than or equal to 112.9

The hypothesis test used is the one sample t-test with the following formula: $t_{hitung} = \dfrac{\bar{X}_{di}}{\dfrac{S_{di}}{\sqrt{n}}}$

(Sudjana, 2005, p.242; Tatsuoka, 1971, p.77)

Explanation:

$\bar{X}_{di} =$ the average of the differences in the data pairs.

$S_{di} =$ standard deviation of the difference in data pairs.

$n =$ number of research samples

Rejection decision criteria H_0 is if $t_{hitung} > t_{tabel}$ to a significant degree $\alpha = 0.05$.

Test the Differences in the Effectiveness of Learning Models

This analysis was conducted to see whether there were differences in the effectiveness of the CIRC learning model in terms of mathematical generalization abilities and self-confidence. In the calculation the data used is student data after being given treatment (posttest), namely using the independent t-test. The independent t-test formula is as follows:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S_{gab}\sqrt{\dfrac{n_1 + n_2}{n_1 . n_2}}}$$ with,

$$S_{gab} = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

(Lestari dan Yudhanegara, 2015, p.282)

Explanation:

n_1 = the number of students in the experimental class

n_2 = the number of students in the control class

s_1^2 = experimental class variance

s_2^2 = control class variance

S_{gab} = standard deviation of the two classes

The Gain test was carried out to see how much the students' abilities increased after being given treatment (treatment).

The increase test is calculated using the gain formula $\langle g \rangle = \frac{\langle Spost \rangle - \langle Spre \rangle}{SMI - \langle Spre \rangle}$

(Lestari dan Yudhanegara, 2015, p.235).

Explanation:

Spre = Pre-test average score

Spost = Post test average score

SMI = Ideal maximum score

The criteria for increasing gain are as follows:

$0{,}7 \leq g \leq 1{,}0$ = High

$0.3 < g < 0.7$ = moderate

$g \leq 0.3$ = Law

RESULTS AND DISCUSSION

The data described are learning achievement data, tests of mathematical generalist abilities, and self-confidence questionnaires obtained from the experimental class before and after being given treatment and in the control class. The results of mathematics learning achievements in the experimental class and control class are presented in Table 1. In Table 1 it can be seen that in the experimental class given the CIRC learning model there was an increase in the average score of 9.83. In addition, Table 1 provides information that the average score of student achievement after being given the CIRC learning model has met the KKM, which is 75.

Tabel 1. Mathematics Learning Achievement Results

Description	Exsperiment		control
	Pre	Post	Post
Average	69.39	87.44	1779
Deviasi Standart	18	18	23
Ideal max	100	100	100
Ideal min	0	0	0
Max	93	100	93
Min	33	71	60
t-test	55.56	94.44	69.57

Based on the results of the analysis, it can be concluded that the CIRC learning model is effective in terms of students' mathematics learning achievement. In table 1 it can be seen that the t-test is 99.44. The CIRC learning model emphasizes cooperative learning models that combine reading, writing, discussing, and presentation activities. This is in line with the opinion of Lestari and Yudhanegara (2015, p.49) who state that CIRC (Cooperative Integrated Reading and Composition) is a type of cooperative learning model. which combines reading activities with other activities, such as writing, discussions, and presentations in an integrated manner. Andriani et al (2014, p.236) revealed that the CIRC learning model is a model that requires students to work together to read to each other, find keywords, provide responses to discourse then write down on sheets of paper. Students interact with each other and communicate findings so as to increase student self-confidence. Student Worksheets (LKPD) contain problems in everyday life related to sequences and series material so that students feel interested in participating in learning. The problems given are in the form of contextual word problems, in which students must manipulate the questions into mathematical forms so that they can improve students mathematical generalist abilities. This is where one of the important roles of CIRC in improving learning achievement.

Research by Siregar (2016, p.15) states that the application of the CIRC learning model can improve generalization (reasoning) abilities in solving problems because cooperative learning prioritizes cooperation between students to achieve learning goals. The results of the study also show that the CIRC learning model is viewed from student achievement. The CIRC learning model emphasizes student collaboration

in finding concepts and solutions to a problem. There are also those who add to the understanding of CICR-type cooperative learning (Slavin, 2010, p.5; Afandi, 2013, p.61) is a comprehensive learning model by reading and writing which involves the cooperation of students in a group where the success of the group depends on the success of each individual in the group.

Based on this, it can be said that the active involvement of students in group activities has a positive effect on students' ability to find solutions so that their learning achievement will also increase. In research conducted by Salantina (2016, p.19) it was found that the use of the CIRC learning model can improve student learning outcomes. Thus it can be concluded that the CIRC learning model is effective in terms of student achievement. In summary, the results of the ability to generalize mathematics in the experimental class are presented in Table 3.

Table 3. Generalization Ablity Result

Description	Pra test	Post Tesr
$\bar{X}$	38.17	48
S	15.44	7.91
Ideal maks.	55	55
Idal Min	0	0
Max.	51	55
Min.	18	39
t_{hitung}	9.43	
t_{tabel}	1.74	
Gain	0.59	

Based on Table 3. the CIRC learning model has increased as shown by the T-Test which is greater than the T table. So it can be concluded that the CIRC learning model is effective in terms of students' mathematical generalization abilities.

The CIRC learning model has many advantages in supporting students' cognitive abilities, one of which is mathematical generalist abilities. Some of the advantages (Istriani, 2011, p.113-114; Type and Lubis, 2016, p.80), namely: (a) Making the learning atmosphere more enjoyable because students study in heterogeneous groups; (b) Debate makes children more relaxed in learning; (c) Can improve cooperation between students; (d) Having a presentation can increase students' enthusiasm in answering questions. Based on these advantages, students are able to practice mathematical generalization skills both in small groups and in large groups, namely in discussion activities. Students are able to conclude and take the essence of discussion activities so that students are familiar with the activity of generalizing information.

In line with this, Dewi et al (2017, p.100) also suggested that learning using the CIRC model affected students' inference abilities so that students were able to solve word problems correctly. This is also in line with research conducted by Siregar (2016, p.15) which states that the CIRC learning model can improve generalization (reasoning) abilities in problem-solving because cooperative learning prioritizes collaboration between students to achieve learning goals.

The results of this study also indicate that the CIRC learning model is effective in terms of students' mathematical generalization abilities. In CIRC learning students are divided into several heterogeneous groups. Then after the students are in groups, the teacher provides material and worksheets that must be understood and completed by students. In understanding the material given by students, it is done individually first. After each student tried to understand the material independently, then group discussions were held to convey the ideas of each student. In addition to discussing the material, students also discussed and tried to complete the LKPD. After the students completed the LKPD in groups, the students made presentations and discussions took place in large groups. Finally, students reflect with the teacher (Lestari and Yudhanegara, 2015, p.49; Andriani et al, 2017).

One of several characteristics of CIRC learning is that the CIRC learning model is a learning model based on collaboration (Durukan, 2011; Triastuti, 2014, p.133), this can be used by teachers to maximize students' mathematical generalist abilities through group activities. In line with research by Triastuti et al which states that the CIRC learning model is said to be effective on students' reasoning abilities. Meanwhile, generalization is an activity that is classified as inductive reasoning and is an important aspect of the thinking process (Lesmana, Hidayat, and Rohaeti, 2018: 864). The generalization ability is important for students, this is because it will affect students' mathematical thinking. This is in line with Hudojo's opinion (Nadia, 2012) which states that thinking mathematically is a mental activity that

uses generalizations in its process. In summary, the results of the self-confidence questionnaire in the experimental class are presented in Table 4.

Table 4. Experiment Class Self-Confidence Questionnaire Results

Description	Pre	Post
Average	112.9	130.0
Standard Deviation	7.39	12.81
Ideal Max	190	190
Ideal Min	0	0
Max	121	154
Min.	94	109
t-test	11.41	
t_{tabel}	1.74	
Gain	0.22	

Based on Table 4, the CIRC learning model's average self-confidence score after treatment is greater than before treatment. Table 4 also provides information that the test for increasing the self-confidence of the experimental class before and after being given treatment has increased by 0.2, which is in the low category

The results of the analysis show that the CIRC learning model is effective in terms of self-confidence. The CIRC learning model is a learning model with the principle of cooperation (Jtipea and Lubis 2016, p.78), with a principle of cooperation making it easier for students to interact, explore, help each other, discuss and argue which can increase students' self-confidence in the learning process. In the exploration process or in finding solutions students can discuss either with friends or with the teacher. Thus, students do not need to hesitate or be afraid when they want to ask questions about things they do not understand. Thus it can be said that the CIRC learning model can increase students' self-confidence.

The research results also show that the CIRC learning model is effective in terms of self-confidence. Self-Confidence is an attitude of confidence in one's own abilities and seeing oneself as a whole person with reference to self-concept (Lestari and Yudhanegara, 2015:95). By believing in their own abilities, of course, students will get used to being independent in doing anything, including mathematical problems (Andriani, et al, 2018: 865). Syam and Amri (2017, p.100) state that self-confidence is one of the affective aspects that students need to have, namely in the form of an attitude of belief in one's own abilities so that they are not influenced by other people, can act according to will, happy, optimistic, quite tolerant and responsible. In line with Walgito's opinion (Fitriani, 2015, p.342; Afiatin and Marataniah, 1998, p.37) which states one way to foster self-confidence is to provide a democratic atmosphere or condition, namely individuals are trained to be able to express opinions to other parties. others through social interaction, trained to think independently and given a safe atmosphere so that individuals are not afraid to make mistakes. In addition, based on research by Siregar (2016, p.10) states that cooperative learning can help students increase positive attitudes, including building confidence in their abilities. The results of the normality test and homogeneity test can be seen in Table 5 and Table 6 respectively.

Table 5. Normality Test Results

Class	Pretest	Posttest	explanation
Experiment	0.167	0.11	Normal
Control	0.17	0.15	Normal

Table 5 shows that data has value $L_{hitung} < L_{tabel}$. It can be concluded that the normality assumptions of both classes are met.

Tabel 6. Homogeneity Test Results

Value	Before	After	explanation
Sig.	0.12	1.97	Homogen

Based on Table 6, it can be seen that the significance value is more than . It can be concluded that the class is in a homogeneous state.

Calculation of the t-test for one sample for the experimental class a month after being given treatment and calculations using the free t-test to determine the effectiveness of the control class and the experimental class using the significance level. The results of the t-test for one sample are presented in Table 7.

Tabel 7. Learning Model Effectiveness Test Results

Group	Variable	t_{hit}	t_{tbl}	explanation
Experiment (Before and after treatment)	Generalization ability	9.43	1.74	Generalization ability of the experimental class after better treatment
	Self Confidence	11.41		The self-confidence of the experimental class after treatment is better
Control and Experiment (after treatment)	Generalization ability	3.26	1.68	The experimental class is better than the control class

Based on Table 7, it can be seen that the value results in rejection. It can be concluded that the CIRC learning model is effective in terms of students' mathematical generalist abilities and self-confidence. The CIRC learning model can simultaneously increase self-confidence and mathematical generalist abilities. This is because in the learning process students can work together in groups to find facts so that they are able to conclude and solve problems. In addition, the learning process is made so that students feel safe in expressing opinions so as to create conducive learning. Such a learning process can improve affective abilities and generalist abilities. This is supported by the opinion of Carl Roger (Lestari and Yudhanegara, 2015: 36) which states that actual learning does not take place if there is no intellectual (cognitive) and emotional (affective) involvement, whereas in the CIRC learning model it is able to integrate cognitive abilities, namely mathematical generalist abilities and affective ability, namely self-confidence. In line with Vygotsky's opinion (Lestari and Yudhanegara, 2015: 32), states that learning done in a group process will provide reciprocal relationships between individuals, between individuals and groups, and between groups and groups. This shows that the CIRC learning model allows students to discuss when learning in class, making learning effective so that students' mathematical generalist abilities and self-confidence become better.

CONCLUSION

Based on the results of the research and data processing at all stages of the research, it can be concluded: the Cooperative Integrated Reading and Composition (CIRC) Learning Model is effective for students' self-confidence and the Cooperative Integrated Reading and Composition (CIRC) Learning Model is effective for students' mathematical generalist abilities.

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