

Value Clarification Technique Integrated with Socioscientific Issues through Role-Playing to Enhance Scientific Literacy in Elementary School

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<p><i>value clarification technique;</i></p> <p><i>socioscientific issues;</i></p> <p><i>science literacy;</i></p> <p><i>elementary school</i></p>	<p><i>This study seeks to examine the differences between the Value Clarification Technique (VCT) model, integrated with socioscientific issues through role-playing, and the more commonly used problem-based learning model in schools. Scientific literacy among elementary school students remains low, necessitating innovative teaching approaches. The research employed a quantitative, quasi-experimental design, specifically utilizing a non-equivalent control group pretest-posttest model. The sample consisted of 71 fifth-grade students, divided into two groups: the experimental group, which received the VCT-based intervention, and the control group, which followed the standard curriculum. Data were collected through pretest and posttest assessments, and hypothesis testing was performed using paired sample t-tests and independent sample t-tests via SPSS 2022. The results indicate that the VCT model, integrated with socioscientific issues through role-playing, significantly improves students' scientific literacy, particularly their ability to explain scientific phenomena. As a critical 21st-century competency, scientific literacy enables students to analyze information, articulate scientific concepts, and draw evidence-based conclusions from data.</i></p>

INTRODUCTION

Background of the Study

Education is universally defined as something that can make humans smarter. Education is a long-term investment to improve the quality of human resources (Abidah et al., 2022). In line with Indonesian educational philosophy, education is defined as an effort to make the nation's life more intelligent (Ima et al., 2023). Therefore, quality education is needed to support the future society to be able to compete (Widiana et al., 2020). The formation of quality human resources is an important

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factor for educational progress (Leomarich & Aure, 2018). This is also a requirement of the goals of Indonesia's national education standards (Ula et al., 2021).

In the 21st century, the competition and challenges faced by students are increasingly complex, so the learning that is applied can produce quality human resources that can adapt to changing times (Nisa et al., 2020). Learning in the 21st century prioritizes student-centered learning activities that are expected to be more innovative, critical, active, and creative (Ibrahim et al., 2020). Learning process activities have the main aim of increasing students' understanding of the material theoretically and practically (Khasawneh & Khasawneh, 2023). Learning process activities can also equip students with various skills contained in learning material, enabling students to apply them to new situations (Konopek et al., 2018).

Science is essentially built based of scientific products, scientific processes, and scientific attitudes (Martalia et al., 2022). Science as learning that discusses real life and relates to nature aims to prepare students to be responsive in dealing with everything in the surrounding environment. Through studying science, students can understand natural phenomena that often occur in the environment (Tias, 2017). Science as a field of science provides discussions about natural phenomena through experiments to find scientific evidence (Wiyono & Budhi, 2018). Natural science is related to living creatures and the nature around them (Rokhiyah et al., 2023). Through active activities by conducting experiments, observations and investigations using imagination, creativity and physical skills (Akuma & Callaghan, 2019; Darmaji et al., 2019; Ecevit & Kingir, 2022)

Natural science studies natural characteristics that are interrelated and provide benefits for social life (Imamora et al., 2020). This shows that the field of natural science in the process of learning involves direct observation (Ismaniati & Iskhamdhanah, 2023). The main aim of science learning is to solve life's problems and understand nature systematically by instilling habits of scientific, critical, creative and independent thinking and behavior. Science is not only limited to a collection of knowledge (scientific products) in the form of facts, concepts and principles but more as a process of discovery (Putri & Jayanta, 2023). The success of science learning influences daily activities and becomes one of the successful efforts to work in the future (Latifah et al., 2022).

Teachers have an important role in knowing and finding each student's lack of knowledge about problems that students often face in daily life. These shortcomings can be found using the right learning methods and techniques (Elbahan et al., 2022). Learning can be said to be successful if the learning objectives are achieved that reflect good behavioral changes that are influenced by the selection of the right learning model (Ima et al., 2023). Learning models can improve student learning outcomes (Malysheva et al., 2022). The learning model are used as external element to influence learning success (Ima et al., 2023).

Problems solve in everyday life by developing the ability to apply the VCT model related to values and morals. The VCT model can be equipped with various techniques and games to stimulate students to explore their internalization and personalization (Anwar et al., 2023). The values contained in the VCT model are not to be memorized but rather to discover, select, analyze, develop, be accountable for, take a stand, and practice each value contained therein (Nurfurqon et al., 2022) Value internalization in learning as a means of knowledge transfer also increases students' awareness of values. (Utyupova et al., 2016). Through a VCT model, it can help students to find and determine values to deal with problems by analyzing the value of the VCT model (Nisa et al., 2020).

Decision-making made by students regarding problems in their social environment is scientific and contains social values. The development of social issues can make students more sensitive and involved in these issues, which will lead to changes in student morals (Lubis et al., 2022). SSI (Socioscientific Issues) uses scientific learning to help study material about a problem from various points of view (Irwanto et al., 2022; Asi et al., 2021). Importance of SSI for solving problems in daily life

by enabling informed decision making (Kolsuz, 2018). The SSI is scientifically studied, and is people-oriented, the SSI is a complex, general and open-ended problem and does not have clear and definitive answers (Özbuğutu, 2022). In fact, SSI has relevance to society's principles and ethics (Jansong et al., 2022).

Problem of The Study

Developing students' abilities to solve problems in everyday life can be implemented through scientific literacy, apart from that, scientific literacy is an indicator for improving the quality of education and human resources in a country (Winata et al., 2018). Scientific literacy is one of the 16 skills needed in the 21st century identified by the World Economic Forum. Scientific literacy can significantly improve students' ability to express scientific ideas or issues. Teachers who have a good understanding of scientific literacy can support and accommodate students' aspirations related to scientific ideas and issues during the learning process (Simamora et al., 2020).

Teachers can involve scientific literacy in the learning process by presenting material that contains facts, concepts, principles and laws. Direct students to answer tabular questions, and present the scientific method in the investigation process to solve problems. (Muzijah et al., 2020). Indonesian students' scientific literacy abilities are still in the low category. This statement is based on PISA data in 2003, 2006, 2009, 2012, 2015, and 2018. In 2003 Indonesia was ranked 38th out of 41 PISA members with an average score of 395. In 2006 Indonesian was ranked 38th. 50 out of 57 PISA members with an average score of 393. In 2009 Indonesian was ranked 57th out of 65 PISA members with an average score of 383. In 2012 Indonesian was ranked 64th out of 65 PISA members with a score average 382. In 2015 Indonesian was ranked 64th out of 72 PISA members with an average score of 403. In 2018 Indonesian was ranked 70th out of 78 PISA members with an average score of 396 (OECD, 2019).

The low level of students' scientific literacy skills is influenced by several factors including: 1) Ignoring the importance of reading and writing as competencies that students must have, especially in the habit of learning science; 2) Lack of students' ability to interpret graphs/tables in questions; 3) Students are not yet able to work on scientific literacy questions (Simamora et al., 2020). Based on these factors, it shows that the learning process influences students' scientific literacy abilities. Apart from that, teachers have an important role in improving students' scientific literacy skills. Increasing students' scientific literacy abilities through the learning process must have the ability to think creatively, construct knowledge to solve problems by mastering the material. This statement is supported by DeBoer's opinion in (Arifiyyati et al., 2023) that scientific literacy includes the ability to use scientific knowledge, identify questions, draw conclusions based on evidence, and explain and predict in solving problems. Students can obtain several of these things in learning science (natural science).

Researchers also carried out a preliminary study at SD Negeri 1 Kebonpedes using observations and interviews. Observations were carried out on October 6, 2023. The results of the observations showed that the science learning process through the lecture method was not based on existing problems. Based on several observations, the researcher asked the fifth-grade teacher through interviews about the difficulties faced during science learning, especially implementing literacy activities. The results of the interview stated that out of 36 students' scientific literacy skills, 13 students could be said to be able to describe scientific problems in the surrounding environment. The VCT model has been implemented by teachers but has not integrated science problems.

Preliminary studies were conducted at elementary school 1 Kebonpedes through observations and interviews with fifth grade teachers. Observations were made on October 5, 2023 during science learning. Science learning process activities are conducted using lecture techniques and using models based on environmental problems. The relationship between environmental problems and scientific learning is still abstract, so when the teacher wants to know students' understanding of the teaching material the teacher has difficulty explaining it. Furthermore, researchers conducted interviews with

fifth-grade teachers aimed at strengthening the results of the preliminary study. The results of the interview concluded that teachers often use environmental problem-based learning models. However, in its implementation, teachers find it difficult to clarify the problem and the problem-solving process as well as the values contained and the benefits that can make students implement it in real life.

Research's State of the Art

Value Clarification Technique (VCT) is a value learning model that directs students to have skills in determining the correct life values in accordance with their life goals (Widiana et al., 2020). Carrying out learning using the VCT model to understand, choose values, decide, and act using morals (Hartono, 2022). VCT gives students the opportunity to express values in their own way (Parmiti, 2018). Some research on applying the VCT model (Awiria et al., 2019; Anwar et al., 2023). The VCT model has functions to 1) Identify and measure students' levels of awareness towards a value. 2) Fostering the values that students have, both positive and negative, to be corrected and improved. 3) Instill values in students in a rational and easily accepted manner (Wiradimadja, 2017).

The problem-based learning model can attract students' attention to try to solve real problems by using their knowledge and using various learning resources around them (Pernantah, 2020). Fifth-grade elementary school students have characteristics in the concrete operational stage. At this stage, students begin to think logically but assisted by concrete media. The values that students learn in this study are abstract. (Badeni et al., 2020). Therefore, the researcher aims to concretize the values so that they can be well digested by students. Values, beliefs and perspectives are factors that influence the way people view social issues (Graham et al., 2022). Teachers teach students to use SSI to solve problems that students encounter in everyday life (Elbahan et al., 2022). SSI can be interpreted as a learning methodology involving morals to deal with social problem (Khoiri et al., 2022).

SSI (Socioscientific Issues) are social issues that are complex, unstructured, and controversial related to conceptual or procedural issues related to science (Leung, 2022). Using SSI has a positive impact in helping students become scientifically literate and have scientific process skills and reasoning (Gürbüzkol & Bakırcı, 2020). SSI supports social and ethical values that can be carried out individually and in groups (Lubis et al., 2022). SSI is a topic rooted in science and society (This et al., 2022: 197). SSI contributes to developing students' understanding of the essence of science (Cebesoy & Rundgren, 2023). The SSI reasoning concept is based on a series of practices performed by students to solve complex SSIs (This et al., 2022: 197).

Learning using SSI is seen as relevant and able to attract students' attention (Cebesoy & Rundgren, 2023). Several studies have proven the success of implementing SSI in the learning process of developing informal reasoning (Jansong et al., 2022). socioscientific reasoning, critical thinking, and scientific literacy (Anisa & Subiantoro, 2022). SSI in education using role-playing is an effective technique to use and relevant for teaching about SSI because the use of SSI produces positive effects in broadening perspectives and argumentation skills (Steube et al., 2023). Role-playing can also increase subject knowledge (Dawson & Carson, 2017). Role-playing games are also very suitable for dealing with ethical issues.

SSI has contributed to the concept of scientific literacy. Various studies discuss the effect of learning using SSI to improve scientific literacy including science content, science competence, and reasoning. Scientific literacy is a skill for understanding scientific processes (Chairunnisa et al., 2021). Students with scientific literacy skills and abilities can solve problems in everyday life, whether it is an individual problem (Hasasiah et al., 201; Baihaqi Rifqi, 2021; Mustakim, 2020). This opinion is in line with Irdausy & Prasetyo (2020) that scientific literacy is students' ability to design, conduct experiments, and interpret data scientifically to solve personal, local, national, and even global problems. This ability can be achieved if students have good attitudes, knowledge and skills in science.

Principally, there are three general terms that have been agreed upon in scientific literacy, namely 1) Scientific literacy is knowledge of scientific concepts and ideas; 2) Scientific literacy is understanding the process of inquiry and the nature of how knowledge is acquired; and 3) scientific literacy is the awareness to influence scientific activities in social contexts and their applications and influence personal and social decision-making (Simamora et al., 2020). There are three indicators of scientific literacy abilities in PISA, namely 1) Identifying, solving, and evaluating natural, and technological problems with science, 2) Describing, evaluating, and formulating solutions scientifically, 3) Analyzing, presenting scientific ideas, and drawing conclusions from data representation (Arifiyyati et al., 2023).

Gap Study & Objective

The Value Clarification Technique (VCT) learning model, as outlined by Destari et al. (2023), has been shown to enhance learning outcomes in elementary education. When combined with local wisdom, the VCT model not only improves students' academic performance but also elevates their learning motivation (Sutrisno et al., 2020). The incorporation of contextual problems into the VCT model fosters the development of social attitudes and strengthens social science learning among elementary school students (Parmiti, 2018). Additionally, Sutrisno (2024) asserts that a local wisdom-based VCT learning model can significantly improve reading literacy in this student demographic.

Similarly, the integration of local socioscientific issues with the OE3C instructional model has been found to improve elementary school students' science literacy (Maulidiawati et al., 2023). This approach has also proven effective in enhancing science literacy in high school chemistry classes, where the combination of local socioscientific issues and the OE3C strategy fosters better science understanding (Saija et al., 2022). In line with this, Wati and Wulandari (2023) reported that science learning rooted in local socioscientific issues increased students' science literacy by 74.75%, categorizing it as "quite effective." Moreover, Muntari et al. (2024) highlighted that the use of Socio-Scientific Issue (SSI)-based e-modules can further enhance science literacy among elementary students.

Differences occurred from theory and previous research regarding the expected ideal conditions and the issues raised. Problems were also found through preliminary studies that were used as research sites. The focus of this research is based on studies that have been described by previous research on the application of the value clarification technique model, socioscientific issues, and role-playing which are integrated into one unit that aims to improve students' scientific literacy in science learning materials in grade V elementary schools.

The literature reveals that the value clarification technique model can lead students to determine life values based on the activities of understanding, choosing values, deciding, and acting by using morals. This study uses a value clarification technique model based on socioscientific issues, namely social problems related to conceptual or procedural problems related to science. The application of the value clarification technique model based on socioscientific issues is carried out through role-playing so that students can feel the values contained in it and decide on attitudes to act using morals. The value clarification technique model based on socioscientific issues through role-playing is believed to improve scientific literacy by identifying science problems, describing, evaluating, and formulating solutions, and analyzing problems by presenting scientific ideas to draw conclusions.

METHOD

Type and Design

This research a quantitative approach with a quasi-experimental research type. The type of research used by researchers is because they cannot fully control external variables that influence the experiment. The design used in this research is a non-equivalent control group pretest-posttest design. The treatment used to produce maximum research was three times. This study aims to determine the

effect of the value clarification technique model integrated with socioscientific issues through role-playing on improving the scientific literacy of fifth grade elementary school students in the experimental group and the control group using a problem-based learning model to improve scientific literacy. The consideration of choosing a problem-based learning model in the control group is because the school is accustomed to using a problem-based learning model (Table 1).

Table 1. Nonequivalent Control Group Pretest Posttest Design

Group	Pretest	Treatment	Posttest
control group	O ₁	X ₀	O ₂
experimental group	O ₃	X ₁	O ₄

Information:

- O₁ : Control class initial ability test
- O₂ : Control class final ability test
- O₃ : Experimental class initial ability test
- O₄ : Experimental class final ability test
- X₀ : Treatment of problem based learning model
- X₁ : Treatment value clarification technique model integrated socioscientific issues

Data and Data Sources

There are two variables in this study, namely the independent variable, namely the value clarification technique model integrated with socioscientific issues through role-playing, and the control variable, namely scientific literacy. The population of this study was all fourth-grade students in Kebonpedes, Sukabumi, West Java Province. Samples are representatives of the population taken in conducting research. The sampling technique used was probability sampling with simple random sampling technique. So that the number of samples in this study were 71 students in the 2023-2024 academic year. The entire sample was divided into two groups, namely group A as the experimental class and group B as the control class. Group A was given treatment in the form of applying the value clarification technique model integrated with socioscientific issues through role-playing, and group B was given treatment by applying a problem-based learning model (Table 2).

Table 2. Sample Grouping

Group	Class	Student
Experimental	IVA	36
Control	IVB	35
Amount		71

Source: Student data for the school 2023-2024 year

Data Collection Technique

Data collection techniques pretest and posttest questions to measure scientific literacy skills in the form of questions that have been tested for validity and reliability. The questions were given to students before and after treatment in each group, namely the experimental group and the control group, each three times, namely the experimental group was treated with the value clarification technique model integrated with socioscientific issues through role-play and the control group was treated by applying problem-based learning (Table 3).

Table 3. Development Indicator scientific literacy

Indicator	Development Indicator
Identifying, solving, and evaluating natural and technological problems with science	<ol style="list-style-type: none"> 1. Identify science problems 2. Evaluate natural and technological problems with science
Describing, evaluating, and formulating solutions scientifically	<ol style="list-style-type: none"> 1. Describe and formulate solutions to solve science problems
Analyzing, presenting scientific ideas, and drawing conclusions from data representation	<ol style="list-style-type: none"> 1. Analyzing the solution 2. Presenting solution ideas 3. Draw conclusions

Data Analysis

Data were analyzed using inferential statistics for advanced analysis involving hypothesis testing and confidence intervals. Before performing inferential statistics, prerequisite tests were first carried out, namely normality test and homogeneity test. Furthermore, hypothesis testing was carried out to determine the effect and significant differences between the experimental group and the control group using paired sample t-test and independent sample t-test using SPSS 2022.

Uji paired sampel t-test

H_0 : The value clarification technique model integrated socioscientific issues through role-playing does not have a significant positive effect on the scientific literacy of class V Kebonpedes Elementary School.

H_1 : The value clarification technique model integrated socioscientific issues through role-playing has a significant positive effect on the scientific literacy of class V Kebonpedes Elementary School.

Uji Independent sampel t-test

H_0 : There is no difference in the scientific literacy abilities of class V students using the value clarification technique integrated socioscientific issues through role-playing and the problem based learning model

H_1 : There is a significant difference in the scientific literacy skills of fifth grade students who apply value clarification techniques integrated with socioscientific issues through role-playing compared to the problem-based learning model.

Hypothesis testing paired sample t-test and Independent sample t-test test using SPSS 22 with the condition that the Sig value <0.05 then H_0 is rejected and H_1 is accepted.

RESULTS

The application of the SSI-based VCT model through role play in this study was carried out using stages categorized into three levels as follows:

1. Freedom of choice
 - a. Learners are given the freedom to choose roles according to their judgment.
 - b. Learners are given choices from several available alternatives and learners can choose freely.
 - c. Learners analyze, and consider the possible consequences of their choices that have been adjusted to science problems that are often found by learners.
2. Appreciation
 - a. Learners act out the character according to the chosen value
 - b. Learners reinforce the value and dare to apply it in real life.
3. Application

- a. Learners show the intention and ability to solve science problems through the values contained in the role play.
- b. The values are applied in their expression in real life.

Before the questions are given to students, namely to determine the increase in students' scientific literacy, validation tests and reliability tests are carried out. The results of the validation test and reliability test are as follows:

Table 4. Data collection technique

No	Pearson Correlation	Sig. (2-tailed)	Conclusion	Interpretasi
1	0,567	0,000	Valid	Medium
2	0,235	0,135	Invalid	Low
3	0,565	0,000	Valid	Medium
4	0,466	0,000	Valid	Medium
5	0,772	0,000	Valid	High
6	0,725	0,000	Valid	High
7	0,637	0,000	Valid	High
8	0,781	0,000	Valid	High
9	0,699	0,000	Valid	High
10	0,760	0,000	Valid	High
11	0,499	0,001	Valid	Medium
12	0,392	0,010	Valid	Low
13	0,381	0,013	Valid	Low
14	0,405	0,008	Valid	Medium
15	0,517	0,000	Valid	Medium

Source: Processed primary data

If the sig value. <0.05 then the question instrument can be said to be valid.

Interpretation of Validity Values

0.800-1.00 = Very High

0.600-0.799= High

0.400-0.599= Medium

0.199-0.399= Low

0.000-0.199= Very Low

Based on Table 4, the results of the analysis of the validation of scientific literacy instruments from 15 questions containing scientific literacy indicators were declared valid at a high level of 6 questions, medium 6 questions, and low 3 questions. Then this study used 12 questions declared valid at high and medium levels.

Table 5. Data collection technique

Reliability Statistics	
Cronbach's Alpha	N of Items
.739	16

Source: Processed primary data

Based on Table 5 the reliability test proposed by Heale and Twycross, namely 0.70 or <0.70, is said to be unreliable. So the test is called reliable because it has a value of 0.739 > 0.70. Table 6 and Table 7 shows that normality test and homogeneity test is valid.

Table 6. Normality Test

Class	Signifikasi	Description
1	0,520	Normal
Posttest	0,370	Normal

Table 7. Homogeneity Test

Signifikasi	Description
0,564	Homogen
0,508	Homogen
0,508	Homogen
0,462	Homogen

Uji paired sampel t-test

Table 8. Paired Samples Test

Signifikasi	Description
0,00	There is a difference

Based on Table 8, It is known that the Sig value. (2-tailed) of 0.000<0.05

H₀: The value clarification technique model integrated socioscientific issues through role-playing has no significant positive effect on scientific literacy in class V of elementary school 1 Kebonpedes

H₁: The value clarification technique model integrated socioscientific issues through role-playing has a significant positive effect on scientific literacy in class V of elementary school 1 Kebonpedes

So H₀ is rejected and H₁ is accepted

Uji Independent sampel t-test

Table 9. Independent Samples Test

Signifikasi	Description
0,00	There is a difference

Based on Table 9, It is known that the Sig value. (2-tailed) of 0.000<0.05

H₀: There is no difference in the scientific literacy abilities of class V students using the value clarification technique integrated socioscientific issues through role-playing and the problem based learning model

H₁: There is a difference in the scientific literacy abilities of class V students using the value clarification technique integrated socioscientific issues through role-playing and the problem based learning model

So H₀ is rejected and H₁ is accepted

DISCUSSIONS

The value clarification technique model that integrates socioscientific issues through role-playing based on the results of the study proved to be very effective and can improve students' scientific literacy skills. The effectiveness of using this model can be applied by teachers in overcoming problems in students' real life later. Because the application uses concrete media and students demonstrate as if they are directly involved in solving problems through role-playing. Through these

activities students can choose, identify, and take the good values contained in it. So that indirectly foster good values in students, especially to carry out social activities.

The application of the SSI-based VCT model through role play can stimulate students to explore their internalization and personalization (Anwar et al., 2023). Internalization of the values contained is used as a means to transfer knowledge so that students can realize good values that can be used as guidelines for life (Utyupova et al., 2016). Realizing the importance of applying the VCT model to deal with problems commonly found by students by analyzing values (Nisa et al., 2020).

Comparison of students' abilities, especially in improving scientific literacy by using the VCT model and the PBL model. The effectiveness of the VCT model is that students can provide solutions to science problems by providing, finding, and arguing about good values that students can apply not only in the learning process but in life. This statement is more effective than the use of the PBL model. Science problems or science issues in science learning to make the right decision (Asi et al., 2021). Students can make the right decision by using SSI because SSI is scientific and community-oriented. SSIs contain complex and open-ended problems and do not have clear or definite answers (Özbuğutu, 2022). The openness of decision making can stimulate students to argue in providing solutions to scientific problems. Elementary school students according to Piaget are at the concrete operational stage, which means that the way students think still uses tools or media to clarify learning materials. In this study, role-playing aims to allow students to experience firsthand the values that can be found to solve science problems. The use of SSI through role-playing is effective and relevant to use (Steube et al., 2023). Role-playing is also able to increase knowledge of learning materials (Dawson & Carson, 2017).

This study aims to improve the scientific literacy skills of fifth grade elementary school students. Scientific literacy can influence students in making decisions on personal or social issues. The teacher's role is to influence students' abilities by looking at science holistically. Based on these statements about scientific literacy, it can be concluded that scientific literacy is an effort made to understand science and is used to adapt to the challenges of a changing world. Scientific literacy skills not only increase knowledge to understand science but can improve students' understanding of the process of science, and apply it in real life (Simamora et al., 2020).

CONCLUSION

The results of this study prove that the application of the value clarification technique model integrated with socioscientific issues through role-playing can improve the scientific literacy skills of fifth grade students. The application of the value clarification technique model integrated with socioscientific issues through role-playing also proved to be more effective than the application of the problem-based learning model in science learning. The limitations of this study can be followed up with other studies to find out other influences that affect the scientific literacy skills of elementary school students. It is hoped that the results of this study can be an inspiration in the application of the VCT model, socioscientific issues, or scientific literacy.

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