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Integration of Local Cultural Visualization in the DACAR Model to Develop Early Childhood Creativity

Gusmaniarti[1], Shoffan Shoffa[2], Wahono[3], Fira May Zahra[4]

[1] Universitas Muhammadiyah Surabaya, Inndonesia; gusmaniarti@um-surabaya.ac.id
[2] Universitas Muhammadiyah Surabaya, Inndonesia; shoffanshoffa@um-surabaya.ac.id
[3] Universitas Muhammadiyah Surabaya, Inndonesia; wahono@um-surabaya.ac.id
[4] Universitas Muhammadiyah Surabaya, Inndonesia; firamayzahra002@gmal.com

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ABSTRACT

This study aims to evaluate the effectiveness of integrating local-wisdom-based visual technology into the DACAR learning model (Description, Analysis, Story, Reflection) to enhance cognitive and creative abilities in early childhood. Conducted at TK ABA 69 Surabaya with 27 children aged 5–6 years, this research employed a descriptive quantitative approach with a one-group pretest–posttest design. Seven indicators of cognitive and creative development were assessed using a 1–3–5 scoring rubric. Data were collected through observation and task-based instruments and analyzed using paired t-tests for normally distributed data or Wilcoxon Matched-Pairs Tests if normality was not met. Descriptive statistics and visualizations complemented the analysis. Results showed that while posttest scores improved across all indicators, only one—children's ability to ask relevant questions—demonstrated statistically significant improvement (median = 0.5; CI = 0.5–1; $p < 0.05$). Other indicators, such as curiosity, analysis, connection to prior experience, creative output, imagination, and local culture recognition, showed nonsignificant changes (median = 0–0.5; $p > 0.05$). These findings indicate that visual technology effectively supports contextual questioning but is insufficient to foster higher-order thinking and creativity within a short intervention period. Contributing factors include prior familiarity with local culture and limited learning duration. This study recommends expanding assessment tools, applying project-based learning, and integrating digital–physical media to better stimulate exploration, critical thinking, and creativity in early childhood education.

Corresponding Author:
Gusmaniarti
Universitas Muhammadiyah Surabaya, Inndonesia; gusmaniarti@um-surabaya.ac.id

1. INTRODUCTION

Early childhood is a crucial stage in developing basic cognitive abilities. At this time, children begin to develop the capacity to understand abstract concepts through real experiences (Aldridge et al., 2024). Therefore, a learning approach that stimulates exploration and reflection is very important (Prasad'Pandey, 2025). Active, collaborative, and authentic learning, as part of the cognitive learning model, can provide opportunities for children to think deeply, solve problems, and build a stronger understanding of the world around them (Johnson et al., 2014) (Ortiz-Alvarez & Arenas, 2025)(Sun et al., 2025). Recent research shows that exploratory learning activities, such as play-based learning, have significant potential to improve problem-solving skills, critical thinking, and conceptual understanding in early childhood (Annuar et al., 2024). In addition, project-based learning and physical activities have also been shown to stimulate deeper cognitive development in children (Salmawati, 2023).

In addition to these developments, the STEAM Loose Part method which emphasizes freedom in exploring and solving problems has proven effective in increasing creativity and problem-solving skills in early childhood (Pereira et al., 2024) (Muntomimah & Wijayanti, 2021). This approach, which is in line with cognitive development theory, allows children to think critically, evaluate situations, and find solutions while forming abstract concepts through real experiences. Thus, this learning model greatly supports the cognitive development stage of early childhood, fostering critical thinking skills needed to face real-world challenges (Mao & Hong, 2025)(Annuar et al., 2024); (Muntomimah & Wijayanti, 2021).

Along with the advancement of globalization and technology, the field of education, especially early childhood education (ECE), has undergone significant changes. One major change is the integration of technology into learning that can enrich children's educational experiences. Visual technology based on local wisdom, such as video, animation, and interactive images, not only enriches the learning process but also helps children understand abstract concepts in a more concrete and interesting way (Sakti et al., 2024b). By utilizing this technology, children can more easily connect learning materials with their daily experiences, thus facilitating deeper understanding (Emi et al., 2024);(Sulistyaningtyas et al., 2023). Recent studies have shown that the use of appropriate technology can improve cognitive, language, and artistic development, as well as increase learning motivation in early childhood (Emi et al., 2024; Sulistyaningtyas et al., 2023). A national teacher survey (Sutiyono et al., 2022) reported that many ECE educators struggle to sustain children's attention and select age-appropriate technological content. Moreover, without adequate training or cultural contextualization, technology risks becoming a passive medium rather than a tool for active learning. This underscores the need for pedagogical models that integrate technology meaningfully—rooted in children's cultural environment and developmentally appropriate practices. As a result, visual technology is a very effective tool for making abstract concepts more relevant and easier to understand for young children (Emi et al., 2024).

However, integrating technology into early childhood education is not without challenges. One problem is that teachers often struggle to maintain children's attention and choose tools that are appropriate to their developmental stage (Sutiyono et al., 2022). Furthermore, integrating local wisdom into early childhood education is increasingly important, as it not only helps children understand their own culture but also prepares them to become global citizens. Although teachers generally have positive attitudes toward the use of technology, they still need support to integrate it effectively into their pedagogy (Sutiyono et al., 2022; Sulistyaningtyas et al., 2023). Therefore, although technology offers great potential, its integration must be implemented wisely and in accordance with the cultural context of children.

In line with these considerations, the DACAR (Description, Analysis, Story, and Reflection) learning model provides an approach that actively involves children in the learning process by encouraging them to collect information, analyze situations, create narratives, and reflect on their experiences. Local culture-based visual technology—such as animated folklore, traditional cultural videos, or AR simulations of traditional houses—can enrich each phase of DACAR. This integration not only introduces children to the local cultural context but also fosters the development of critical thinking skills (Kuhn, 1999) (Nabavi, 2012). Existing studies support the importance of embedding local culture into early childhood education, as it increases children's engagement and sense of ownership of learning materials, while strengthening their cultural identity (Oppong & Strader, 2022)(Sakti et al., 2024a). Early introduction to local culture has been shown to foster politeness, nationalism, and openness to other cultures, while effectively fostering moral values and socio-environmental character (Afriliani et al., 2023) (Badruli et al., 2019). Thus, incorporating local wisdom-based visual technology into the DACAR model not only enriches the learning experience but also contributes to cultural preservation and character building.

The research problem that arises from this study is how the application of local culture-based visual technology can be more effective in improving the cognitive abilities of early childhood, especially critical and creative thinking (Watson et al., 2023). Although visual technology has been proven to be beneficial in several aspects, the main challenge is how to optimize its use to stimulate high-level thinking skills such as analysis and creativity, which have not been fully achieved through current learning approaches.

This study aims to develop and implement the DACAR learning model combined with local culture-based visual technology to improve children's cognitive abilities. The novelty of this study lies in the integration of local culture-based visual technology into the DACAR model, which offers a more contextual and culturally relevant approach to children's experiences. This study focuses not only on cognitive development but also on developing a deeper appreciation of local cultural values. In addition, this study seeks to explore the potential of visual technology in strengthening critical and creative thinking skills among children, an area that is relatively under-researched.

This study aimed to investigate the effectiveness of integrating local-wisdom-based visual technology into the DACAR (Description, Analysis, Story, Reflection) model to enhance cognitive and creative development in early childhood learners. It was hypothesized that the implementation of this model would lead to measurable improvements in children's curiosity, critical thinking, and cultural understanding. The implications of this study are important for educators, content developers, and policy makers. For teachers, this study provides insights into more effective ways to integrate visual technologies into early childhood learning. For educational content developers, this study offers guidance in designing more interactive and culturally-based learning materials. For policy makers, these findings can serve as a basis for developing innovative and culturally relevant curricula that meet the needs of early childhood education in the digital age. It is hoped that the results of this study will provide meaningful contributions to the development of curricula and learning strategies that holistically support children’s growth amidst rapid technological advances.

2. METHODS

Type and Approach of Research

This study employed a quantitative approach using a descriptive statistical method with a one-group pretest–posttest design to evaluate the effectiveness of the DACAR (Description, Analysis, Storytelling, and Reflection) learning model integrated with local wisdom-based visual technology for early childhood education. The purpose of this design was to measure learning outcomes before and after the intervention, allowing researchers to assess changes in children's cognitive and creative development.

Subject and Object of Research

The research was conducted at TK ABA 69 Surabaya during March–April 2025. The research subjects consisted of 27 children from Kindergarten B class, aged 5–6 years. The object of research was the implementation of the DACAR learning model supported by culturally relevant visual technologies—specifically Augmented Reality (AR), animated videos, and interactive digital illustrations.

This study employed a quantitative approach using a descriptive statistical method with a one-group pretest–posttest design to evaluate the effectiveness of the DACAR (Description, Analysis, Storytelling, and Reflection) learning model integrated with local wisdom-based visual technology for early childhood education. The purpose of this design was to measure learning outcomes before and after the intervention, allowing researchers to assess changes in children's cognitive and creative development.

Planning

The local wisdom-based learning planning stage begins with selecting a theme that is relevant to the cultural context of the students. Some steps taken in this stage are:

a) Selection of Local Wisdom-Based Learning Themes

The themes focus on aspects of local culture that are easily recognizable to children, such as traditional houses, folklore, and traditional foods. These themes are chosen to introduce culturally relevant values and familiarize children with the richness of Indonesia's cultural diversity.

b) Choosing Visual Technology that is Appropriate to the Child's Age and Abilities

The visual technologies used in this learning model include Augmented Reality (AR), animated videos, and interactive images. AR is used to introduce cultural objects interactively, while animated videos are used to present folk tales in an interesting way. The technology chosen is adjusted to the level of cognitive development and abilities of early age learners.

2.Implementation

The implementation stage is carried out according to the previously prepared plan. At this stage, several learning activities are carried out involving visual technology based on local wisdom:

a) Using AR to Introduce Local Cultural Objects

Children are introduced to cultural objects through AR technology, such as traditional houses and cultural symbols. The use of AR provides an interesting and interactive learning experience for children.

b) Screening of Animated Folk Tale Films

Animated videos are used to illustrate folktales related to local culture. Children are encouraged to discuss the stories, recognize the values contained in them, and relate these values to their daily lives.

c) Involving Children in Digital Games

Children participate in digital games designed to enhance their critical and creative thinking skills. The games focus on problem-solving tasks related to the cultural themes being studied.

Evaluation

The evaluation stage is carried out to assess the extent to which learning objectives have been achieved. This stage uses a combination of assessment rubrics and activities that allow children to retell their learning experiences.

a) Assessment Rubric

The assessment is based on a rubric that includes children's participation in DACAR activities, their ability to describe cultural objects, and their understanding of the folklore studied. The rubric and assessment instruments are presented in Table 1.

b) Retelling learning experiences

Children are given the opportunity to share their experiences through speaking or drawing activities, which allows them to integrate and reflect on the knowledge they have acquired.

Table 1. Assessment Rubric and Instruments

Indicator	Pretest Instrument	Posttest Instrument	Score (1, 3, 5)
1. Children show curiosity by asking questions.	Show a picture of a local cultural object (e.g. a traditional house) and ask: "What do you want to ask about this?" Note whether the child asks what the question is.	After studying, show the same picture and ask again: "Any new questions?"	1 = No questions 3 = There are simple questions 5 = There are in-depth questions
2. Children's questions are relevant to the material presented.	When children ask about cultural objects, pay attention to whether their questions are about the function or characteristics of the object.	After studying, pay attention to whether the child's questions are still in accordance with the material being taught.	1 = Not relevant 3 = Relevant but simple 5 = Relevant and in-depth
3. Children are able to connect visuals with previous experiences or knowledge.	Ask: "Have you ever seen something similar to this at home or school?"	After studying, ask again: "What do you remember from this lesson?"	1 = No connection 3 = Mentions one experience 5 = connects to more experiences
4. Children demonstrate the ability to analyze or conclude information.	After watching the animated video, ask: "What happened in this story?"	After the discussion session, ask: "What did you learn from the story?"	1 = Cannot conclude 3 = Mentions parts of the story 5 = Connects the message or moral story
5. Children get to know and understand local cultural elements through visual technology.	Ask after viewing AR or video: "What do you see in this picture?"	Ask after studying: "What do you know about this traditional house or story?"	1 = Don't know 3 = Mentions little information 5 = Mentions local cultural characteristics
6. Children are able to create something based on the visual technology they see (example: drawing, telling stories)	After viewing a picture or video, give children the opportunity to draw or tell a story about what they saw.	After studying, give children the opportunity to create more creative pictures or stories about local culture.	1 = No drawing / story telling 3 = Simple drawing / story telling 5 = Drawing / story telling with detail and imagination
7. Children demonstrate imagination and creativity in activities using visual technology.	Ask: "put together" your own story based on the pictures you see!	After studying, give children the opportunity to create their own storyline from the material studied.	1 = No imagination 3 = Simple imagination 5 = Very creative imagination

Data Collection Techniques

Data were collected through pretest and posttest assessments aligned with a 7-indicator rubric covering curiosity, relevance of questioning, experiential connections, analysis, cultural understanding, creative production, and imaginative thinking. Instruments were developed based on expert-validated indicators and underwent content validity checks through expert judgment from three early childhood education professionals. Reliability testing was carried out using inter-rater reliability methods during a pilot session, achieving a coefficient of agreement above 0.80, which indicated strong consistency among assessors.

Data Analysis Techniques

Quantitative data from pretest and posttest results were analyzed using descriptive and inferential statistics.

- To determine whether the data were normally distributed, the Shapiro–Wilk test was applied due to the small sample size ($n < 50$).
- If normality was confirmed, a paired t-test was used to assess the significance of score differences.
- If data were not normally distributed, the Wilcoxon Matched-Pairs Test was employed.
- Both tests were conducted using a 95% confidence interval to determine statistical significance ($p < 0.05$). Results were also supported by visual comparisons of mean scores across all indicators to reinforce interpretation.

3. FINDINGS AND DISCUSSION

Figure 1. illustrates the comparison of the average pre-test (blue) and post-test (green) scores on seven indicators of the DACAR learning model based on local wisdom visual technology. Next, each indicator will be discussed in depth, referring to the visualization while maintaining the descriptive statistical results and supported by relevant literature.

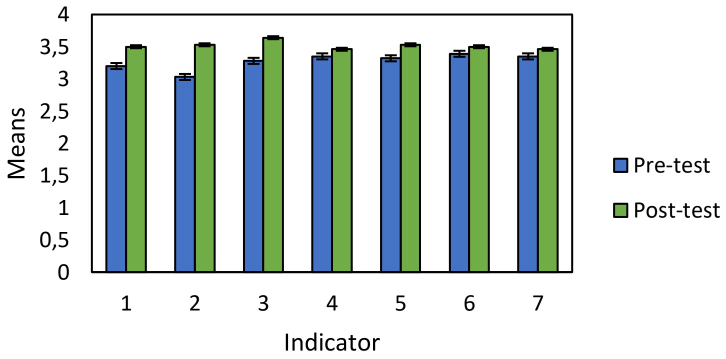

Figure 1. Comparison of average pre-test (blue) and post-test (green) scores.

Table 1. Summary of Pretest-Posttest Differences per Indicator

Indicator	Description	Median Difference	95% Confidence Interval	Significance
1	Curiosity (Asking questions)	0.5	(0, 0.5)	Not Significant
2	Relevance of questions	0.5	(0.5, 1)	**Significant**

Indicator	Description	Median Difference	95% Confidence Interval	Significance
3	Connection to prior knowledge	0.5	(0, 0.5)	Not Significant
4	Analytical skills (HOTS)	0.0	(0, 0.5)	Not Significant
5	Understanding local culture	0.0	(0, 0)	Not Significant
6	Creative expression	0.0	(0, 0.5)	Not Significant
7	Imagination and creativity	0.0	(0, 0.5)	Not Significant

The first indicator shows a median difference between posttest and pretest scores of 0.5, with a 94.98% confidence interval ranging from (0, 0.5), indicating a slight increase but not statistically significant. This suggests that although some children experienced an increase in curiosity, the change was not consistent across all respondents, which may be influenced by factors such as children's confidence in asking questions and the social climate of the classroom. Previous studies have shown that direct and interactive interventions—such as hands-on science demonstrations—tend to be more effective in fostering curiosity. For example, (Gurel, 2016) reported a significant increase in students' scientific curiosity scores after a hands-on demonstration. Similarly (Özkan & Topsakal, 2020) found that nature education activities can increase affective tendencies toward the environment and scientific curiosity. In contrast, interventions limited to a single quiz format do not always result in meaningful change, as D'Souza and Manjunath (2020) did not observe significant improvements after a one-time quiz intervention, underscoring the importance of intervention design that considers duration, intensity, and learning context.

On the other hand, the second indicator shows a median difference of 0.5, with a 94.98% confidence interval ranging from (0.5, 1), which statistically confirms a significant increase between pretest and posttest scores. This finding highlights that visual technology-based learning effectively helps children in asking questions relevant to the material, in line with the principles of contextual learning that connects material to concrete experiences through visualization. Empirical evidence suggests that visual technology can improve students' understanding and motivation to learn, while teaching students to formulate questions about the material being studied has been shown to significantly improve understanding, with median effect sizes ranging from 0.36 to 0.86 depending on the type of assessment (Rosenshine et al., 1996).

While the second indicator recorded a significant increase, the third indicator showed a median difference of 0.5, with a confidence interval between (0, 0.5), indicating that although there was some improvement, the difference was not statistically significant as the confidence interval included zero. These findings suggest that children's ability to connect visuals to prior experiences or knowledge is influenced by their diverse backgrounds and life experiences. Visual literacy is essential to help children navigate and interpret visual media, with significant benefits if introduced early (Lopatovska, 2016). Picture books, for example, offer children the opportunity to connect personal experiences and express them through visual art (Mantei & Kervin, 2014). Such an approach can increase self-awareness, foster creativity, and promote empathetic perspectives on human similarities and differences (Shipe, 2018), highlighting the importance of further exploration in actively engaging students in visual-based learning.

However, despite the observed improvement in the third indicator, the fourth indicator showed a median difference of 0.0, with a confidence interval between (0, 0.5), indicating no statistically significant change between the pretest and posttest scores. This may be due to the fact that the ability to analyze and draw conclusions is a higher-order thinking skill (HOTS), which cannot be developed through passive visual presentation alone. This skill requires a more exploratory and interactive learning environment that allows students to think critically, analyze information in depth, and draw structured conclusions. HOTS is essential in 21st-century learning which includes skills such as analyzing, evaluating, and creating (Dhewa et al., 2017). To effectively foster HOTS, educational approaches must actively engage students in problem-solving activities while fostering creativity and innovation (Jaenudin et al., 2020) (Smith et al., 2005). Thus, to develop HOTS, education must incorporate not only visual strategies but also interactive and problem-solving-based methods. More interactive and collaborative strategies are needed (Gillies, 2016)

In line with the emphasis on higher-order thinking skills discussed in the fourth indicator, the fifth indicator showed a median difference of 0.0, with a very narrow confidence interval (0, 0), indicating no variation or change in scores. This suggests that the local cultural material presented through visual technology was already very familiar to the children from the beginning, or that there was a ceiling effect, where the children had already mastered the material. As a result, the intervention did not produce significant additional impacts. Research has shown that interventions that utilize multimedia and culturally relevant materials can effectively improve a variety of skills in young children. For example, a learning trajectory-based curriculum significantly improved preschoolers' math skills (Clements et al., 2011). However, in some cases, interventions may not show significant impacts if children are already familiar with the material or have reached a ceiling of learning.

The sixth indicator shows a median difference of 0.0 with a confidence interval between (0, 0.5), indicating that although some respondents showed improvement, the overall difference was not statistically significant. The ability to create something, such as drawing or telling stories, requires more in-depth creative stimulation and practice. The visual materials presented may not be challenging or stimulating enough to trigger a strong creative drive in children. Therefore, a learning approach that focuses more on creative exploration, such as project-based activities or workshops, is needed to foster children's creative expression. Research shows that developing children's creativity requires a targeted approach and a stimulating environment. The project-based learning model has shown promising results in enhancing children's creativity (Sadaruddin et al., 2023). Therefore, learning could better support these skills (Runco & Acar, 2012). In addition, a pragmatic approach to creativity has also been successful in stimulating children's cognitive creative skills and overall development (Kusnadi & Ismail, 2020). These findings underscore the importance of diverse and tailored methods to foster children's creative expression and development.

Similar to the findings for the fourth and sixth indicators, the seventh indicator showed a median difference of 0.0, with a confidence interval between (0, 0.5), indicating that although there was some improvement, the change was not statistically significant. Imagination and creativity are complex competencies that cannot be stimulated through passive visualization alone. Without exploratory activities and open-ended challenges to develop imagination, children may not show significant changes in creativity. A more dynamic and project-oriented learning approach would be more effective in fostering imaginative and creative skills in children. Research shows that creative activities and imagination play a significant role in children's cognitive and creative development, with activities such as music, art, and storytelling enhancing originality and problem-solving skills (Aulakh et al., n.d.). Creative visualization techniques have also been shown to have positive effects on children's independence, innovation, and collaboration (Piasecka, 2022). These methods, which go beyond passive visualization, offer exploratory activities and open-ended challenges that can lead to significant improvements in children's creativity and cognitive abilities.

The results of this study provide meaningful insights into the pedagogical practices of early childhood education, particularly in integrating culturally grounded visual technology into the DACAR (Description, Analysis, Storytelling, Reflection) learning model. While visual-based learning has proven effective in enhancing children's ability to formulate contextually relevant questions, the findings also reveal that other cognitive and creative dimensions—such as analysis, imagination, and creation—require more than visual stimulation alone (Zabelina et al., 2021). This suggests that educators should not rely solely on visual media but must complement it with exploratory, project-based, and collaborative learning experiences that allow children to engage in deeper, hands-on learning. From a theoretical standpoint, this study contributes to the evolving discourse on the fusion of local cultural content with digital pedagogy in early childhood education. It underscores that while digital visuals can effectively bridge abstract and concrete learning, the cultivation of higher-order thinking skills (HOTS) and creativity demands a more scaffolded approach that includes sustained inquiry, reflection, and social interaction. Based on the findings, future research should consider extending the duration of interventions to allow cognitive processes to mature over time, utilize broader and more sensitive measurement instruments—such as a 1–5 scale rubric—to capture nuanced progress, and employ mixed-method approaches to explore deeper learning experiences. Moreover, the inclusion of control groups is recommended to strengthen the causal validity of future studies. Altogether, the integration of local wisdom and visual technology within a structured model like DACAR holds great potential, but its impact depends heavily on thoughtful implementation that aligns with the developmental needs and diverse learning styles of young children.

Another way to improve the effectiveness and efficiency of DACAR is to incorporate elements of the STEAM method into the learning model. (Wang & Degol, 2017) found that the STEAM method can train critical thinking skills in early childhood. In addition, design-based STEM activities have been shown to contribute to the development of critical thinking in children. A study conducted on students showed a significant increase in critical thinking skills after implementing the STEAM model, with the success rate increasing from 20% before the intervention to 80% after two cycles of implementation (Lubis, Gurning, & Yus, 2023). This approach fosters creativity, problem-solving skills, and scientific inquiry. STEAM is a great fit for early childhood education, as it integrates the hard and soft skills that children need (PRIYANTI et al., 2023). The application of STEAM in one of the educational subjects, such as mathematics, can improve students' cognitive, affective, and psychomotor abilities in dealing with technological advances (Nurhikmayati, 2019). Research shows that STEAM-inspired learning, such as through video tutorials, can effectively develop critical thinking skills in young children (Rahayu, Nurani, & Meilanie, 2023). In addition, STEAM experiences can boost children's self-confidence and encourage them to build knowledge about the world around them through observation, investigation, and questioning (Daher & Shahbari, 2020)

4. CONCLUSION

Among the seven indicators analyzed, only the second indicator showed a statistically significant increase in post-test scores, while the others did not show significant differences. This suggests that the impact of the intervention implemented was not evenly distributed across all aspects assessed. Certain skills, such as analysis and creativity, may require more time and more in-depth methods to develop higher-order thinking skills and creative expression.

This study highlights the importance of using interactive, project-based, and culturally relevant approaches in early childhood learning. Educators are encouraged to integrate visual and experiential methods that go beyond passive viewing. Future research should extend the intervention period, involve a more diverse group of participants, and improve the assessment instruments—such as using a wider scoring scale and including observational tools. Comparative studies using control groups are also recommended to strengthen the evidence on the effectiveness of the DACAR model integrated with local visual content. In the future, improving learning outcomes will require strengthening more interactive and project-based methods that can better support the development of critical thinking skills and creativity in young children.

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