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# Analysis of the Practicality of Ethnoscience-Based Science Learning Modules to Improve Scientific Literacy of Students at SMP Negeri 1 Sendana

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**Abstract**
This study aims to analyze the practicality of the ethnoscience-based science learning module developed by the researcher to improve the scientific literacy of students at SMP Negeri 1 Sendana. The research employed the ADDIE development model stages (analysis, design, development, implementation, and evaluation). The development stage focused on the implementation and evaluation of the module's practicality. The study subjects consisted of 25 eighth-grade students and 2 educators at SMP Negeri 1 Sendana. The results showed that the ethnoscience-based science learning module was considered practical, as evidenced by high validation scores from the two educators and the students, indicating ease of use, relevance to local culture, and effectiveness in improving students' scientific literacy. This study provides contextual teaching materials integrating the local wisdom of Mandar culture, aiming to enhance students' scientific literacy and learning motivation while promoting the preservation of local culture through education. The developed learning module incorporates local cultural aspects such as *Bau Peapi*, *Golla Mamingga*, and *Kecaping Mandar* with modern science concepts, offering a novel approach to connecting science and local culture. The module is also designed to explore the impact of ethnoscience-based learning on students' motivation, understanding, and appreciation of their own culture.

**Keywords**
Practicality, Learning Module, Ethnoscience, Scientific Literacy, SMP Negeri 1 Sendana

## MATERIALS AND METHODS

The subjects in this study were eighth-grade students at SMP Negeri 1 Sendana, with a sample size of 13 students participating in the field trial. This study used several research instruments, including 1) Validation sheets, which were used to obtain data on the validity and practicality of the ethnoscience-based science learning module as assessed by experts. Several aspects evaluated by the researcher included validator identity, evaluation date, evaluation guidelines, general assessments of the learning module, comment columns, and suggestions for improvement, complemented by theoretical practicality assessments.

In addition, student response questionnaires and teacher response questionnaires were also used as instruments in this study. These sheets aimed to determine the responses of students and teachers regarding the module developed by the researcher. The questionnaires included several indicators of student responses after using the ethnoscience-based science learning module. This was done to assess the practical level of the developed product in practice.

The final instrument used was a test sheet, which included scientific literacy assessments designed to evaluate students' scientific literacy abilities both before and after using the learning module developed by the researcher. The tests were constructed based on scientific literacy indicators, developed by the researcher, and consulted with academic supervisors before being validated by experts/validators.

The procedure in this research and development of the module was based on the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation). The choice of the ADDIE development model was based on several reasons, including its clear and systematic development stages, the development studies directing educators toward productivity by producing a complete learning module product, and the relevance of the learning module development procedures to the principles of learning module development.

At the analysis stage, problem identification was carried out at the research location through interviews with teachers and students in science subjects and field observations, measuring three aspects: needs analysis, goal analysis, and analysis of the characteristics of students and teachers. At the design stage, the researcher designed the learning module (initial draft) and conducted an assessment of its validity, practicality, and effectiveness. The instruments used to assess the validity and practicality of the learning module were validation sheets completed by subject matter experts, media experts, and education practitioners.

In the development stage, the researcher developed the product according to the planned design. The module created was assessed by four validators, consisting of two lecturers and two science subject teachers. Subject matter experts assessed the content feasibility, implementation of scientific literacy indicators, ethnoscience orientation, language use, and presentation. Media experts evaluated the presentation, graphical feasibility, and visual quality of the module. Meanwhile, education practitioners assessed the theoretical practicality of the module. The practical application of the module was evaluated through student response questionnaires after using the module. The results from the experts were used as a reference for revising the module, which would then be reassessed by the experts until the product (module) was declared valid and theoretically practical. Once the module was deemed valid and practical, it was ready for implementation in the learning process by teachers and students in the classroom.

At the implementation stage, the researcher applied the product (module), which had been declared valid and practical, in a limited trial in an eighth-grade class with 13 students selected using simple random sampling. At this stage, students were first given pre-test questions to determine their initial scientific literacy abilities, followed by post-test questions after using the module to evaluate their final scientific literacy abilities. Afterward, students were also given questionnaires to evaluate the practical application of the ethnoscience-based science learning module in practice.

The evaluation stage was carried out at each phase of product (module) development. In the design stage, the initial draft was evaluated by academic supervisors. In the development stage, the learning module was evaluated by experts. In the implementation stage, the module was evaluated by students. The evaluation results were used by the researcher to conclude the outcomes of the development research that had been conducted.

This research used analysis techniques based on the stages of the ADDIE development model. At the analysis stage, data collected from observations and interviews were analyzed descriptively and qualitatively through a data reduction process. The needs analysis was conducted to allow the researcher to describe the current conditions and learning situations to achieve optimal learning goals.

The design stage included activities involving qualitative descriptive document analysis, where the researcher provided an overview of the flowchart of the ethnoscience-based science learning module to be developed as a result of the document analysis. This included designs that aligned with the needs analysis results.

At the development stage, data from validators were analyzed descriptively and quantitatively to determine the validity and reliability of the developed module. The analysis of the validity of the teaching module components was conducted based on the following steps:

(Details of these steps would be specified in further stages of the research)

$$V = \frac{\sum S}{N\,(C-1)}$$

*Explanation*:

V = index of expert agreement on item validity
S = R− L0
L0 = the lowest validity rating score
C = the highest validity rating score
N = the number of experts/validators
R = the score assigned by the expert

To interpret the content validity values obtained from the calculations above, the researcher will use the following validity classification:

**Table 1** Interpretation of Validity Values

| Score Range | Interpretation |
|---|---|
| 0.80<V≤1.00 | Very strong |
| 0.60<V≤0.80 | Strong |
| 0.40<V≤0.60 | Moderately strong |
| 0.20<V≤0.40 | Low |
| 0.00<V≤0.20 | Very low |

This study employed a reliability test using the Cronbach's alpha formula technique.

$$\alpha = \frac{N}{N-1}\left(1 - \frac{\sum si2}{s2t}\right)$$

*Explanation*:

α = Cronbach's Alpha
N = Number of items (questions) in the instrument
si2 = Variance of the scores for each individual item
s2t = Total variance of the overall scores (sum of all item scores)

After obtaining rcalculated, this value will be compared with the rtable value to determine whether the instrument is reliable. The calculation is conducted at a 5% or 1% significance level, and the instrument is considered reliable and suitable for use in research if it meets the criteria. To interpret the reliability level of the instrument, the standard measurement levels provided by Arikunto (2008) will be used:

**Table 2** Interpretation of Reliability Values

| Range of *r* | Interpretation |
|---|---|
| 0.80-1.00 | Very Strong |
| 0.60-0.80 | Strong |
| 0.40-0.60 | Moderately strong |
| 0.20-0.40 | Low |
| 0.00-0.20 | Very low |

During the implementation stage, the collected data will be analyzed quantitatively and descriptively to describe the practicality of the ethnoscience-based science learning module that has been developed. The student response data reflecting the practicality of the developed science learning module will be analyzed using the following formula:

$$PRS = \frac{\sum A}{\sum B} x100\%$$

*Explanation*:

PRS = The percentage of student responses
$\sum A$ = Total Score Obtained by Student Responses
$\sum B$ = Maximum Score of the Response Questionnaire

**Table 3** Interpretation of Student Response Percentages

| Precentage Range (%) | Interpretation |
|---|---|
| < 20,00 | Not positive |
| 21,00 – 40,00 | Less positive |
| 41,00 – 60,00 | Moderately positive |
| 61,00 – 80,00 | Positive |
| 81,00 – 100 | Very positive |

This table is used to interpret the percentage of student responses in evaluating the module's reception and practicality based on their feedback.

## RESEARCH RESULTS

### Practicality Assessment Results from Science Educators' Responses

This study validated the practicality of the module with science educators at SMP Negeri 1 Sendana. The validators consisted of two eighth-grade science educators from the school. The validation process aimed to gather evaluations, feedback, and suggestions regarding the module from the science educators at SMP Negeri 1 Sendana, as illustrated in the diagram below:

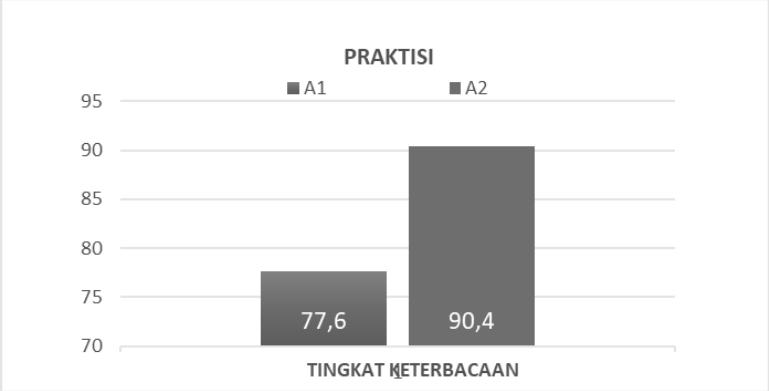


**Fig. 1** Diagram of Educators' Readability Responses

The diagram illustrates the comparison of the practicality/readability levels of the ethnoscience-based science teaching module as assessed by practitioners. There are two assessment items, A1 and A2, which yielded readability scores of 77.60% and 90.40%, respectively. Based on these results, it can be concluded that the module developed by the researcher demonstrates a fairly good level of practicality/readability, with an average score of 83.60% from the two practitioner assessors.

The high practicality/readability score is a crucial aspect in the development process of an ethnoscience-based teaching module, as good readability ensures that students can easily comprehend the material being taught, particularly in connecting science concepts with local wisdom. A module that is easy to understand allows students to focus more on the learning process without encountering limitations in reading the displayed text. These scores are relevant to improving scientific literacy at SMP Negeri 1 Sendana, as a well-designed, highly readable module is more effective in delivering learning concepts, especially in integrating science with local culture (Mandar).

The validity of the practicality/readability of the ethnoscience-based learning module was analyzed using the Cronbach's alpha formula, as shown in the following table:

**Table 4** Validity Values for the Practicality/Readability of the Module by Educators

| No | Assessment category | Number of Items | V (Aiken's V) | Description |
|---|---|---|---|---|
| 1 | Very high | 20 | 0.82 - 0.96 | Readability is very good |
| 2 | Low | 2 | 0.26 - 0.28 | Needs improvement |
| 3 | Quite low | 3 | 0.17 - 0.19 | Requires significant improvement |

This table presents the assessment results of the practicality/readability of the module by educators, highlighting areas of strength and those requiring improvements. Items with "Very High" validity indicate excellent readability, while "Low" and "Quite Low" categories identify specific items needing revisions to enhance the module's effectiveness.

The validity results of the practicality/readability questionnaire assessed by educators in the dissertation titled **"Analysis of the Practicality of Ethnoscience-Based Science Learning Modules to Improve Students' Scientific Literacy at SMP Negeri 1 Sendana"** indicate that the majority of the evaluated items demonstrated very good practicality/readability. However, some aspects require refinement. Of all the items evaluated, 20 items showed very high validity scores with Aiken's V values ranging from 0.82 to 0.96. This indicates that educators assessed the module as easy to understand and relevant to the students' needs in the learning process. The module developed by the researcher was considered to have successfully presented material that supports the improvement of students' scientific literacy through an ethnoscience-based approach, aligning with the learning objectives intended by the researcher.

The validation results also identified two items classified as having low validity, with Aiken's V values ranging from 0.26 to 0.28. This suggests that the researcher should make adjustments to certain parts of the module to enhance its comprehensibility for students. Additionally, three items were categorized as having quite low practicality/readability, with Aiken's V values ranging from 0.17 to 0.19. This indicates a significant need for revisions to ensure the content is clearer and more accessible to students.

Overall, the items in the teaching module were rated by educators as having good practicality/readability. However, the presence of items with low validity scores highlights the need for improvements and revisions to the developed module. These adjustments are necessary to ensure the module fully supports the primary objective of its development: to enhance students' scientific literacy through an ethnoscience-based approach. By addressing the items with low scores and implementing the required revisions, the module is expected to provide optimal benefits to students. The reliability values for the practicality/readability of the module, as assessed by educators, are as follows:

**Table 5** Cronbach's Alpha Values for Practicality/Readability of the Module by Educators

| ***Cronbach's Alpa*** | **N of item** |
|---|---|
| 0,70 | Fairly Good |

This table shows the Cronbach's Alpha value for the practicality/readability assessment of the module as rated by educators. The reliability value of 0.70 indicates that the module's practicality/readability is categorized as "Fairly Good," reflecting moderate consistency in the evaluation of the module.

The table above shows a Cronbach's Alpha value of 0.70, which falls under the "Fairly Good" category and indicates that the practicality/readability questionnaire used to evaluate the ethnoscience-based science teaching module has adequate internal consistency. While the value is not very high, the reliability obtained is still considered sufficient to serve as a reference for measuring educators' perceptions of the module's practicality/readability. Consequently, this questionnaire provides reasonably accurate information about educators' evaluations of the module's practicality/readability, an essential aspect for assessing and improving the module in the future.

In the development process of the ethnoscience-based science teaching module for SMP Negeri 1 Sendana, the practicality/readability aspect, as assessed by educators, is a key factor supporting the effectiveness of student learning. A module that is readable and understandable for educators allows students to easily integrate modern scientific concepts with local wisdom (Mandar) effectively. The good reliability of the questionnaire indicates that educators consistently rated the ease of use and understanding of the module.

Good practicality/readability in a module not only helps students understand the content but also facilitates the delivery of material to students. The module is designed to introduce scientific concepts using a relevant cultural approach. By ensuring that the module is effective for educators, the learning process becomes more engaging and contextual, ultimately supporting the improvement of students' scientific literacy. Moreover, the reliability of the practicality/readability questionnaire provides a solid foundation for educators to use the data to revise and refine the module, making it more effective in the future.

**Analysis of Students' Practicality/Readability Responses**

Based on the practicality/readability assessments conducted by science educators at SMP Negeri 1 Sendana, the next step is to analyze students' responses to the ethnoscience-based science teaching module. The module was tested with 13 eighth-grade students at SMP Negeri 1 Sendana. After the learning process using the module, a questionnaire was distributed to measure students' responses regarding readability, attractiveness, and the relevance of the material presented in the module.

The students' responses to the module can be visualized in a diagram that illustrates their evaluations of various aspects of the module. The diagram will depict how students assess the ease of understanding the module content, its relevance to local culture, and the appeal of the learning material. These results will serve as important evaluation points for refining the module to make it more effective in supporting learning and enhancing students' scientific literacy. The results of the student response questionnaire regarding the ethnoscience-based science teaching module can be seen in the diagram below:

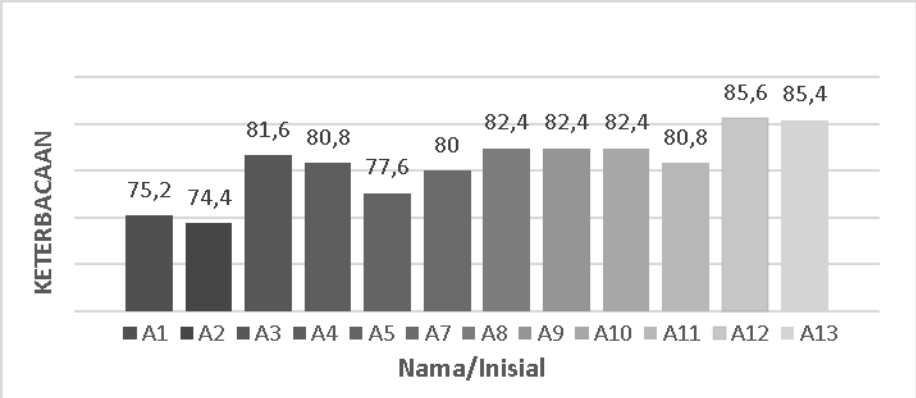


**Fig. 2** Diagram of Students' Practicality/Readability Responses

The diagram presented highlights the practicality/readability assessment results for the ethnoscience-based science teaching module from various evaluators, with scores ranging from 74.4 to 85.6. Evaluators with the initials A12 and A13 gave the highest scores, 85.6 and 85.4 respectively, indicating that the module was very easy to understand for the majority of the evaluators. Additionally, other evaluators, including A3, A4, A8, A9, and A10, provided scores above 80, reinforcing the conclusion that the module generally has a good readability level. On the other hand, some scores fell into the lower category, such as evaluators A1 and A2, with scores of 75.2 and 74.4, respectively. These scores fall within the "moderate" category but indicate that certain parts of the module need improvement and revisions to ensure it is more easily understood by all parties (educators and students).

The evaluation results of this module have significant implications for the development of ethnoscience-based science teaching modules at SMP Negeri 1 Sendana. A module with a high practicality/readability level, achieving a score of up to 80.86%, is expected to effectively help students understand the material presented in the module. This is particularly important when science concepts are contextualized through the local wisdom of Mandar. A good level of

practicality/readability ensures that students can easily grasp the relationship between modern science concepts and the local environment surrounding them, thereby improving their overall scientific literacy.

The low scores given by some evaluators on specific items indicate the need for revisions to certain parts of the module to ensure that all content can be accessed and understood effectively by all users, including readers, practitioners, and students. The validity and reliability values related to the practicality/readability of the teaching module, analyzed using Cronbach's alpha formula, are shown in the following table:

**Table 6** Validity Results of the Practicality/Readability of the Module by Students

| No | Assesment catgeory | Number of items | V (Aiken's V) | Description |
|---|---|---|---|---|
| 1 | Very high | 13 | 0.81 - 1.00 | Readability is excellent |
| 2 | High | 11 | 0.60 - 0.80 | Readability is good |
| 3 | Moderate | 1 | 0.50 | Requires improvement |

The validity results of the practicality/readability questionnaire for students in this study, titled **"Analysis of the Practicality of Ethnoscience-Based Science Learning Modules to Improve Students' Scientific Literacy at SMP Negeri 1 Sendana,"** indicate that most items scored within the "Very High" category. Out of the 25 items analyzed by experts, 13 items were classified as having very high practicality/readability, with Aiken's V values ranging from 0.81 to 1.00. These findings demonstrate that the majority of the module's content was well-designed and easily understood by students, supporting the primary objective of developing the module: effectively improving students' scientific literacy.

Another 11 items were categorized as having high practicality/readability, with Aiken's V values ranging from 0.60 to 0.80. Although these values are slightly lower than those in the "Very High" category, they still indicate that the module possesses a good level of practicality/readability and effectively conveys the material to students. However, one item fell into the "Moderate" category with a validity score of 0.50. This indicates that certain parts of the module require improvements to enhance students' understanding during the learning process. Revisions to these parts are expected to further support the goal of developing the module: improving students' scientific literacy.

Overall, the validity results of the practicality/readability evaluation show that the developed teaching module effectively and accurately supports students' scientific literacy. Nevertheless, some revisions and improvements are still necessary to ensure that all module content can be optimally understood by students. The high validity scores for the practicality/readability of this module align with the dissertation's objective to produce an ethnoscience-based module that effectively enhances students' scientific literacy. The reliability results for the module's readability as assessed by students are presented in the following table:

**Table 7** Cronbach's Alpha Values for the Practicality/Readability of the Module by Students

| ***Cronbach's Alpa*** | **N of item** |
|---|---|
| 0,71 | Fairly Good |

Based on the table presented, the Cronbach's Alpha value of 0.71 indicates that the reliability of the practicality/readability questionnaire for the ethnoscience-based science teaching module is classified as "Fairly Good." This suggests that the instrument used in the module demonstrates adequate consistency in evaluating various aspects of practicality/readability as assessed by the respondents. While there are areas for improvement, the obtained value shows that the questionnaire is sufficiently reliable for assessing the module's practicality/readability with an acceptable level of confidence.

The relevance of this finding to the development of ethnoscience-based science teaching modules at SMP Negeri 1 Sendana is significant, especially in supporting students' scientific literacy. A module that integrates modern scientific concepts with local cultural wisdom (Mandar) must be systematically designed in an accessible language and format for students. The Cronbach's Alpha value of 0.71 for student feedback on practicality/readability indicates that respondents' evaluations of the module were consistent and can serve as a basis for further evaluations to improve the quality of the teaching module.

A well-designed module with high readability will help students connect scientific concepts to their daily lives within their local environment. This implies that the approach can significantly improve students' scientific literacy. With a "Fairly Good" practicality/readability instrument, the module developers can identify which aspects need improvement and ensure that the module is not only easy to understand but also aligned with learning objectives. The reliability value reinforces the confidence that the module can be effectively implemented in ethnoscience-based student learning processes. It also demonstrates that the module helps students understand science through an approach that is more relevant to their local culture.

## DISCUSSION

The evaluation stage of practicality/readability is a critical component in assessing the success of teaching material development, as practicality reflects the extent to which a learning module can be easily and effectively implemented in real learning scenarios. In the context of ethnoscience-based science learning, the practicality of the module is designed to ensure that the teaching materials are not only easily accessible but also flexible enough to support diverse learning needs and conditions.

This aligns with the findings of Magdalena, Sundari, Nurkamilah, Nasrullah, and Amalia (2020), who emphasized that teaching materials must adhere to the principles of relevance, consistency, sufficiency, and characteristics such as being self-contained, user-friendly, and adaptive—all of which are elements of practicality in teaching materials. The same article also explained that practical teaching materials help educators and students achieve a more efficient and effective learning process. This indicates that practicality is an essential element in supporting classroom learning.

The practicality assessment shows that the learning module was rated practical, with an average score of 83.6% from educational practitioners and 80.8% from students during limited trials. These results indicate that the module is suitable for use with minimal revisions or improvements required. Research by Handayani, Muhali, and Pahlia (2024) highlights that modules designed with high effectiveness and feasibility, incorporating problem-based learning (PBL), successfully encourage active student engagement, develop critical thinking, and enhance learning motivation through relevant problem-based activities.

This learning module was designed to ensure high practicality, making it easy for users (educators and students) without requiring complex training. This is supported by research from Sary, Yulinda, and Putri (2023), which found that a well-designed practical module simplifies material delivery for educators and aids students in understanding lessons more effectively. In ethnoscience-based science learning, practicality is highly relevant as this approach combines local cultural knowledge with complex scientific concepts, necessitating a module that allows educators and students to easily comprehend and relate both aspects.

The practicality of this teaching module not only supports its efficient use but also offers significant advantages, particularly in terms of management. The module is designed to facilitate storage and retrieval according to user needs. This ease of use provides flexibility highly relevant to the demands of modern learning, which is often conducted in various formats, both online and offline. Research by Eugara and Efendi (2023) found that e-modules significantly improve students' learning outcomes in cognitive, affective, and psychomotor domains.

Additionally, this ethnoscience-based teaching module not only offers efficiency in its use but also provides significant benefits in terms of appeal. The module delivers a unique learning experience by connecting scientific concepts to cultural contexts familiar to students. Furthermore, its usefulness is evident in its flexibility for various learning contexts, whether as a primary or supplementary teaching resource. This aligns with research by Imaduddin and Sundi (2024), which found that locally-based teaching materials provide added value and effectively enhance students' learning experiences. Similar findings by Akmalia, Situmorang, Anggraini, Rafsanjani, Tanjung, and Hasibuan (2023) suggest that culturally-based approaches can increase student motivation and engagement in the learning process, ultimately contributing to educational advancement.

In terms of efficiency and effectiveness, this module supports more optimal learning outcomes by minimizing preparation time for the learning process. Research by Sholikha, Farid, and Andriansyah (2022) highlights the importance of using modules to help students learn more effectively and catch up on missed material. The module's accessibility, usable anytime and anywhere, supports 21st-century learning principles centered on students.

Based on the assessment results and supporting research, this ethnoscience-based science learning module has proven to be practical and suitable for use in learning activities. The practicality of this module offers ease and flexibility in its implementation, while its ethnoscience-based content effectively bridges scientific concepts with local wisdom values. This has been shown to not only enhance students' understanding but also strengthen their engagement and motivation in learning. Therefore, this module is expected to serve as an effective educational tool, creating a more dynamic, inclusive, and relevant learning process for students' daily lives.

## CONCLUSION AND IMPLICATIONS

The designed module was evaluated as practical based on assessments conducted by both educators and students. The practicality of the module is reflected in its ease of use, adaptability to various learning conditions, and integration with other teaching methods. With a practicality score of **82%**, the module is deemed effective for implementation in the learning process, requiring minimal revisions or improvements. Additionally, the module is easily accessible to all users, including educators and students.

## CONFLICT OF INTEREST STATEMENT

The researchers declare no conflict of interest regarding the publication of this article. This research was conducted independently, with no financial or personal relationships that could influence the reported outcomes.

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