



BESUReK Model-Based Student Worksheets Grounded in Bengkulu Local Wisdom for Facilitating Elementary Students' Science Literacy

Diyoba Azhar Fuadi^{1*}; Merri Sri Hartati¹; Adi Asmara¹

1 Master of Pedagogy Program, Faculty of Teacher Training and Education, Universitas Muhammadiyah Bengkulu, Bengkulu, Indonesia

Email: azharf413@gmail.com; merrisrihartati@umb.ac.id; adiaasmara@umb.ac.id

*Corresponding author: azharf413@gmail.com | ORCID: [0000-0000-0000-0000]

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Abstract: Science literacy among Indonesian elementary students remains low, partly because science lessons rely on lectures and generic worksheets detached from learners' cultural contexts. This study aimed to develop a student worksheet based on the BESUReK learning model (Baca-Eksplorasi-Susun-Uji-Review-Komunikasi: read, explore, construct, test, review, communicate), which uses the Besurek textile motif of Bengkulu as contextual scaffolding, for the topic of human growth and development, and to determine its validity and practicality. Following the ADDIE (analysis, design, development, implementation, evaluation) research and development model, the worksheet was validated by content, media, and language experts and trialled with two teachers and fifth-grade students at two public elementary schools in Seluma Regency (limited trial, n = 16; field trial, n = 30). Data were collected through validation sheets, practicality questionnaires, observation, and semi-structured interviews and were analysed descriptively as percentages. The worksheet was rated very valid (content 95.6%, media 94.1%, language 94.3%; mean 94.7%) and very practical (teachers 95.3%, students 90.0%). Observations indicated active discussion and questioning, although some students struggled to interpret instructions and draw conclusions without teacher guidance. The BESUReK-based worksheet is feasible as a culturally grounded resource for elementary science learning; its effect on science literacy requires experimental testing.

Keywords: BESUReK learning model; ethnoscience; local wisdom; science literacy; student worksheet

Abstrak: Literasi sains siswa sekolah dasar di Indonesia masih rendah, antara lain karena pembelajaran IPA bertumpu pada ceramah dan lembar kerja generik yang terlepas dari konteks budaya peserta didik. Penelitian ini bertujuan mengembangkan Lembar Kerja Peserta Didik (LKPD) berbasis model pembelajaran BESUReK (Baca, Eksplorasi, Susun, Uji, Review, Komunikasi) yang memanfaatkan motif kain Besurek Bengkulu sebagai scaffolding kontekstual pada materi pertumbuhan dan perkembangan manusia, serta menentukan validitas dan kepraktisannya. Penelitian menggunakan desain penelitian dan pengembangan model ADDIE (analisis, desain, pengembangan, implementasi, evaluasi). LKPD divalidasi oleh ahli materi, media, dan bahasa, kemudian diujicobakan kepada dua guru dan siswa kelas V di dua SD negeri di Kabupaten Seluma (uji terbatas, n = 16; uji lapangan, n = 30). Data dikumpulkan melalui lembar validasi, angket kepraktisan, observasi, dan wawancara semi-terstruktur, lalu dianalisis secara deskriptif dalam bentuk persentase. LKPD dinilai sangat valid (materi 95,6%, media 94,1%, bahasa 94,3%; rata-rata 94,7%) dan sangat praktis (guru 95,3%, siswa 90,0%). Observasi menunjukkan siswa aktif berdiskusi dan bertanya, meskipun sebagian siswa masih kesulitan memahami instruksi dan menarik kesimpulan tanpa bimbingan guru. LKPD berbasis model BESUReK layak digunakan sebagai sumber belajar IPA berbasis budaya lokal di sekolah dasar; pengaruhnya terhadap literasi sains perlu diuji secara eksperimental.

Kata kunci: etnosains; kearifan lokal; literasi sains; LKPD; model pembelajaran BESUReK

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Introduction

Science literacy—the capacity to explain phenomena scientifically, interpret data and evidence, and use scientific knowledge in everyday decisions—is a core outcome of basic education (OECD, 2023). Indonesian students, however, continue to perform poorly on this outcome. In the Programme for International Student Assessment (PISA) 2022, Indonesia's mean science score was 383 points, 13 points lower than in 2018 and roughly 100 points below the OECD average (OECD, 2023). National studies attribute this weakness to poorly selected teaching materials, misconceptions arising from coverage-oriented teaching, non-contextual instruction, and weak reading habits (Fuadi et al., 2020; Suparya et al., 2022). Even among prospective elementary teachers, science tends to be learned as a body of products rather than as a process, and lessons rarely connect content to learners' lived contexts (Fakhriyah et al., 2017). The Merdeka Curriculum responds to these problems by emphasising student-centred, project-based, and contextual learning (Martin & Simanjorang, 2022; Rahmadayanti & Hartoyo, 2022), but such reform depends on classroom resources that translate its principles into concrete learning activities.

These national patterns were also evident in the schools where this study was conducted. Preliminary observations of fifth-grade science and social studies (*Ilmu Pengetahuan Alam dan Sosial*, IPAS) lessons at two public elementary schools in Seluma Regency, Bengkulu Province, showed that teaching was dominated by lectures and assignments, that teachers relied on textbooks and commercially published worksheets, and that students had few opportunities to explore, discuss, or experiment. Teachers cited limited time, references, and skills as barriers to developing their own materials. In a teacher's formative assessment on an earlier topic (force), nearly 60% of students could not relate the concept to events they had experienced, and many answered from memory without justification. Students also showed limited familiarity with the meanings of local cultural traditions, which had not been used as learning resources.

Student worksheets (*Lembar Kerja Peserta Didik*, LKPD) are structured instructional resources containing activity instructions, work steps, and tasks that guide learners toward targeted competencies (Kaffa & Miaz, 2022). Unlike generic commercial worksheets, teacher-developed materials can be tailored to learners' characteristics and needs (Prastowo, 2020). Contextual teaching that links content to learners' real-world experience has been shown to improve science achievement among Indonesian students (Suryawati & Osman, 2018), and ethnoscience—an approach that connects scientific concepts with the knowledge and values of

local communities—offers one way to provide such context (Suwandani et al., 2022; Septina, 2025). Integrating local wisdom into elementary science has been argued to foster both cultural appreciation and scientific competence (Meilana & Aslam, 2022; Muyassaroh et al., 2024) and to support culturally grounded science literacy (Nazara et al., 2025).

A growing body of development research supports this direction. An ethnoscience-based module on ecosystems for grade V was found feasible and practical and helped students relate scientific concepts to their cultural and environmental surroundings (Melawati & Istianah, 2022). An e-module integrating STEM and ethnoscience through traditional musical instruments was reported to develop 21st-century skills (Zakiah & Sudarmin, 2022), and ethnoscience-based worksheets have been reported as valid and practical for developing junior secondary students' scientific argumentation (Novanda et al., 2024) and students' creative thinking in chemistry (Indah et al., 2024). Materials oriented explicitly to science literacy have also been developed for elementary science, including problem-based worksheets (Tamam & Sudibyo, 2023) and flipbook media (Nurwidiyanti & Sari, 2022), as well as an electronic worksheet on growth and development in biology learning (Zahroh & Yuliani, 2021).

Two limitations of this literature motivate the present study. First, in most of these products local culture functions as content or illustration rather than as an organising pedagogical structure: activities are not sequenced through a learning syntax that systematically moves learners from a cultural stimulus to exploring, organising, testing, reviewing, and communicating scientific ideas. Second, few products target the grade V IPAS topic of human growth and development, and none draws on the cultural heritage of Bengkulu. The BESURReK learning model (Asmara, 2024) offers a culturally rooted syntax that addresses both limitations. Inspired by Besurek, the Bengkulu textile tradition decorated with Arabic-Malay calligraphy and symbolic motifs, the model combines principles of contextual teaching and learning and project-based learning in six phases—*Baca* (read), *Eksplorasi* (explore), *Susun* (construct), *Uji* (test), *Review*, and *Komunikasi* (communicate)—and treats culture as both a source and a medium of learning. Its motifs, which express repetition, development, and continuity, provide a natural analogy for the continuous process of human growth and development (Asmara, 2024). To the authors' knowledge, however, the model has not yet been operationalised as a student worksheet and evaluated in elementary science classrooms.

Accordingly, this study developed a BESURReK model-based student worksheet on human growth

and development that embeds science literacy competencies in each phase of the model and uses the Besurek motif as a contextual scaffold. The study addressed two research questions: (1) How valid is the worksheet according to content, media, and language experts? (2) How practical is the worksheet according to teachers and students? The study contributes a culturally grounded instructional resource for implementing the Merdeka Curriculum and initial evidence on the feasibility of the BESUREK model in elementary science.

Method

Research Design and Setting

This study employed a research and development design using the ADDIE model (analysis, design, development, implementation, and evaluation), chosen because each stage incorporates evaluation and revision that support iterative product improvement (Adeoye et al., 2024). Quantitative data were used to determine validity and practicality, and qualitative data from observation and interviews were used to describe how the worksheet functioned in class and to guide revision; the evaluation was therefore descriptive-evaluative. The study was conducted at SD Negeri 109 Seluma (Kampai Village) and SD Negeri 82 Seluma (Serambi Gunung Village), Talo District, Seluma Regency, Bengkulu Province, Indonesia, from November 2025 to April 2026, during the even semester of the 2025/2026 academic year. The schools were selected because preliminary observation indicated low science literacy, teacher-centred IPAS instruction, and reliance on conventional materials.

Participants, Sample, or Data Sources

The population comprised all 46 fifth-grade students at the two schools who were studying human growth and development in the IPAS subject. Participants were selected purposively as representatives of the intended users and of the local sociocultural context of Bengkulu. Product testing proceeded in two stages: a limited trial with 16 fifth-grade students at SD Negeri 109 Seluma, selected for similar academic ability and active participation, to examine readability, clarity of language, accuracy of content, and visual appeal; and a field trial with 30 fifth-grade students from both schools to examine practicality during complete lessons. Trial sizes were determined by the number of fifth-grade students available in the two schools. Two fifth-grade classroom teachers assessed practicality from the teacher's perspective. Expert validation was carried out by lecturers holding doctoral degrees at Universitas Muhammadiyah Bengkulu with experience in science education and teaching-material development, who assessed the content, media, and language aspects of the worksheet.

Instruments and Measures

Three expert validation sheets were used. The content sheet covered the suitability, accuracy, and currency of the material, presentation feasibility, language feasibility, and integration of science literacy. The media sheet covered worksheet size, cover design, and content design, and the language sheet covered straightforwardness, communicativeness, dialogic and interactive quality, suitability to learners' development, and conformity to Indonesian language rules. Items were rated on a five-point scale, and each sheet provided space for comments and suggestions. Practicality was measured with a teacher questionnaire (students' interest in the worksheet, content and science literacy, and language and presentation) and a student questionnaire (interest in the worksheet, content and science literacy, and language), both on five-point scales. During the limited trial, a student response questionnaire with four categories (very good, good, fairly good, and poor) was also administered. Qualitative data were collected with a non-participant observation sheet on student activity and the implementation of the BESUREK phases and with a semi-structured interview guide for teachers and students addressing material needs, content suitability, visual display, and ease of use. Science literacy was operationalised through worksheet activities requiring students to understand scientific information, formulate hypotheses, organise and interpret data, and communicate findings.

Procedure and Research Ethics

In the analysis stage, learning needs, learner characteristics, the Merdeka Curriculum IPAS learning outcomes, and school facilities were examined through classroom observation and teacher interviews. In the design stage, the worksheet structure was mapped onto the BESUREK syntax, content was compiled from elementary IPAS textbooks and Merdeka Curriculum teaching modules, the draft was written in Microsoft Word 2019, and the layout, colours, typography, and illustrations were produced in Canva; the validation instruments were prepared at the same stage. In the development stage, the experts validated the draft and the worksheet was revised according to their comments. In the implementation stage, the revised worksheet was used in the limited trial, during which students were observed, interviewed, and surveyed; the worksheet was revised again and then used in the field trial, after which teachers and students completed the practicality questionnaires. Evaluation was carried out formatively throughout all stages. The study was conducted with research permission from the participating schools, and students' names are not reported.

Data Analysis

Validation and practicality scores were converted into percentages using the following formula:

$$P = (\Sigma x / \Sigma x_{\max}) \times 100\%$$

where P is the percentage, Σx is the total score obtained, and $\Sigma x_{\max}$ is the maximum attainable score. Validity percentages above 81% were categorised as very valid. Practicality percentages were categorised as very practical (85–100%), practical (70–84%), fairly practical (55–69%), or not practical (< 55%). The worksheet was considered feasible if the experts rated it very valid and its practicality reached at least 85%. Observation notes, interview responses, and validators' comments were summarised descriptively and triangulated with the questionnaire results to identify strengths and revision needs.

Results and Discussion

Results

The results are presented in the order of the ADDIE stages; the development stage answers the first research question (validity), and the implementation stage answers the second (practicality).

Analysis stage. The needs analysis confirmed that lessons on human growth and development relied on lectures and textbooks and that existing worksheets consisted mainly of practice questions that did not require students to think critically, link concepts to daily life, or apply science literacy. Assessment focused on factual knowledge, with little attention to explaining phenomena, interpreting data, or applying concepts. Fifth-grade students were curious about phenomena concerning themselves, preferred concrete, visual, and collaborative activities, and responded well to pictures, stories, and cultural elements, but they struggled to connect the topic to phenomena around them. The curriculum analysis identified IPAS learning outcomes that emphasise observing, questioning, gathering information, reasoning, and communicating; the topic covers the concepts of growth and development, the factors influencing them, and the stages of human life. Classrooms, textbooks, posters, and simple teaching aids were adequate, and the planned activities required no special equipment.

Design stage. The design stage produced a worksheet structured around the BESURReK syntax (Table 1). Its opening sections comprise a cover with Bengkulu cultural elements, the worksheet identity (IPAS, grade V, semester 2), competencies, learning objectives, and instructions; its closing sections ask students to write a conclusion and an individual reflection on positive behaviours that support their

own growth and development. The Besurek motif opens the *Baca* phase as a stimulus: its patterns of repetition, development, and continuity serve as an analogy for the continuous changes humans undergo from infancy to old age.

Table 1. Structure of the BESURReK-based worksheet and the science literacy focus of each phase

Phase	Worksheet activity	Science literacy focus
<i>Baca</i> (read)	Observe a Besurek motif, read a contextual text linking the motif to human growth and development, and answer trigger questions	Understanding scientific information; activating prior knowledge
<i>Eksplorasi</i> (explore)	Observe pictures or a video of human life stages and formulate a hypothesis	Posing questions; formulating hypotheses
<i>Susun</i> (construct)	Complete a table of the characteristics of growth and development from infancy to old age	Organising and classifying information
<i>Uji</i> (test)	Answer questions distinguishing growth from development with everyday examples	Interpreting evidence; testing understanding
<i>Review</i>	Write down the key points learned	Reflecting; drawing conclusions
<i>Komunikasi</i> (communicate)	Compose questions and answers and present the results	Communicating scientific ideas

Note. Phase names follow the BESURReK syntax (Asmara, 2024). The worksheet also contains a cover, identity, competencies, learning objectives, instructions, a conclusion task, and an individual reflection.

Development stage: validity. The expert validation results are summarised in Table 2. The content expert awarded 430 of 450 possible points (95.6%); all content aspects scored 94.0% or higher, with the highest ratings for suitability of the material and integration of science literacy (96.7% each). The media expert awarded 254 of 270 points (94.1%), with cover design rated lowest (91.4%). The language expert awarded 132 of 140 points (94.3%), with the dialogic and interactive aspect rated lowest (90.0%). The mean across the three aspects was 94.7%, placing the worksheet in the very valid category.

Table 2. Expert validation results

Aspect	Score	Max.	%
Content expert			
Suitability of material	29	30	96.7
Accuracy of material	47	50	94.0
Currency of material	38	40	95.0
Presentation feasibility	172	180	95.6

Aspect	Score	Max.	%
Language feasibility	86	90	95.6
Science literacy	58	60	96.7
Subtotal	430	450	95.6
Media expert			
Worksheet size	19	20	95.0
Cover design	64	70	91.4
Content design	171	180	95.0
Subtotal	254	270	94.1
Language expert			
Straightforwardness	19	20	95.0
Communicativeness	19	20	95.0
Dialogic and interactive	18	20	90.0
Suitability to learners' development	19	20	95.0
Conformity to language rules	57	60	95.0
Subtotal	132	140	94.3
Mean of the three aspects	-	-	94.7

Note. Max. = maximum attainable score. All aspects and subtotals fall in the very valid category (> 81%).

The validators' comments led to four main revisions: the material was made more complete, and the Besurek image and illustrations were repositioned and replaced with pictures of elementary school children; a QR code linking to an educational video and additional animations were added; the layout and wording of the questions were restructured to make them easier for elementary students to understand; and the colour scheme was changed. Figure 1 shows examples of pages before and after revision.



Figure 1. Examples of worksheet pages before (a, c) and after (b, d) revision based on expert validation

In the revised pages, the material is more complete, illustrations depict elementary school children, a QR code links to a learning video, and questions are restructured for easier comprehension.

Implementation stage: limited trial. In the limited trial ($n = 16$), observation showed that most students participated enthusiastically, particularly in group discussion, answering questions, and completing tasks; they exchanged opinions, cooperated, and asked more questions while relating the material to daily life. Some students, however, had difficulty understanding instructions written in long or insufficiently specific sentences and hesitated to begin tasks without additional direction from the teacher. In interviews, most students described the worksheet as attractive and easy to use because of its colours, relevant pictures, examples, and varied activities, whereas several reported that some questions were unclear and asked for worked examples. Of the 240 ratings on the student response questionnaire, 217 (90.42%) were in the very good category and 23 (9.58%) in the good category, with none in the lower categories. Students also suggested simpler instructions, more pictures, and videos accessible through a scannable code. On the basis of the triangulated data, question wording and language were simplified, supporting pictures were added, and the QR-code video link was integrated before the field trial.

Implementation stage: practicality. Table 3 presents the practicality results. The two teachers gave 143 of 150 possible points (95.3%), rating students' interest in the worksheet highest (96.7%) and language and presentation lowest (93.3%). They judged the worksheet easy to use, with clear instructions and a systematic presentation aligned with the learning objectives, and noted that it encouraged students to observe, ask questions, discuss, and discover concepts. In the field trial, the 30 students gave 2,835 of 3,150 possible points (90.0%), with 90.0% on each aspect. Both results fall in the very practical category and exceed the 85% criterion.

Table 3. Practicality of the worksheet according to teachers and students

Aspect	Score	Max.	%
Teachers (n = 2)			
Students' interest in the worksheet	58	60	96.7
Content and science literacy	57	60	95.0
Language and presentation	28	30	93.3
Subtotal	143	150	95.3
Students, field trial (n = 30)			
Interest in the worksheet	810	900	90.0
Content and science literacy	1,620	1,800	90.0
Language	405	450	90.0
Subtotal	2,835	3,150	90.0

Note. Max. = maximum attainable score. All values fall in the very practical category (85–100%).

Evaluation stage. Formative evaluation across the ADDIE stages identified strengths in the contextual needs analysis, the systematic mapping of activities onto the BESUReK syntax, and the iterative cycle of validation and revision. It also identified weaknesses: no structured diagnostic instrument was used to measure students' initial science literacy, the initial design was not previewed with users before development, and the effect of the worksheet on learning outcomes was not measured.

Discussion

The first research question concerned validity. The consistently high expert ratings indicate that the worksheet aligns its objectives, material, and activities and presents them in a form suited to fifth-grade students. In educational design research, validity concerns whether a product is grounded in current knowledge and is internally consistent (Nieveen, 2013); the high content ratings for suitability of the material and science literacy integration suggest that embedding literacy competencies into each BESUReK phase achieved this coherence. The ratings are comparable to those reported for other ethnoscience-based worksheets

and modules (Indah et al., 2024; Melawati & Istianah, 2022; Novanda et al., 2024), and the evaluation and revision built into each ADDIE stage likely contributed to them (Adeoye et al., 2024). The comparatively lower ratings for cover design and for the dialogic and interactive quality of the language are also informative: they identify the visual and communicative features that most needed revision, which corresponds with the limited-trial finding that some instructions were too long.

The second research question concerned practicality, that is, whether a product is usable in the setting for which it was designed (Nieveen, 2013). Both teachers and students rated the worksheet very practical, and the teachers' comments indicate that it can be used with only minor adjustments to classroom conditions. This is noteworthy because the schools had only basic resources; since the BESUReK activities rely on a cultural motif, pictures, and discussion rather than special equipment, the worksheet appears suited to schools with limited infrastructure. Similar practicality has been reported for problem-based worksheets targeting elementary students' science literacy (Tamam & Sudibyo, 2023) and for ethnoscience-integrated worksheets (Sya'diyah et al., 2023). The students' ratings were lower than the teachers', which is consistent with the difficulties some students reported in interpreting instructions.

Beyond the ratings, the observation and interview data suggest how the worksheet functions. The Besurek motif in the *Baca* phase gave students a familiar entry point, and the subsequent phases moved them from observation to hypothesis, organisation, testing, and communication. This sequence operationalises the content, process, and context dimensions of science literacy that elementary students need to develop progressively (Utami et al., 2022), and it targets the lack of contextual connection identified as a cause of low science literacy (Fakhriyah et al., 2017; Fuadi et al., 2020). Contextual and culture-based learning has been associated with better science achievement and process skills (Dari et al., 2025; Suryawati & Osman, 2018), and active learning more generally improves performance relative to lecturing, as shown for undergraduate STEM courses (Freeman et al., 2014). The increased discussion, questioning, and expression of opinions observed in this study are consistent with these findings and with the view that well-designed learning environments support both the cognitive and the social dimensions of learning (Darling-Hammond et al., 2020). Whereas many earlier ethnoscience products use culture mainly as illustration, the BESUReK worksheet uses a cultural artefact to open a structured inquiry sequence, which is the main contribution of this study (Asmara, 2024; Nazara et al., 2025).

At the same time, some students struggled to interpret instructions and to draw conclusions, which shows that a well-designed worksheet does not remove the need for teacher guidance. Culture-based learning depends on teachers helping students interpret cultural meanings as part of their scientific understanding (Laksana et al., 2021), and the *Review* and *Komunikasi* phases, in which students must synthesise and articulate conclusions, appear to require the most scaffolding. Teachers using the worksheet should therefore plan explicit modelling of how to formulate hypotheses and conclusions, and future revisions could add the worked examples that students requested.

Pedagogically, the findings suggest that a local cultural artefact can be embedded in the structure of an inquiry sequence rather than added as decoration, offering teachers a practical way to implement the contextual and project-oriented principles of the Merdeka Curriculum (Muyassaroh et al., 2024; Rahmadayanti & Hartoyo, 2022). Several limitations should be noted. The study assessed validity and practicality only; science literacy was not measured with a pre-test and post-test, so no claim can be made about the worksheet's effect on science literacy. Validity rested on a small number of expert judgements from a single institution, and the reliability of the instruments was not examined. Practicality data were summarised as aggregate percentages from two schools in one district, which limits generalisation. Future studies should test the worksheet's effectiveness through experimental or quasi-experimental designs using a validated science literacy test, involve independent validators, and trial the worksheet in more schools.

Conclusion

This study developed a BESURReK model-based student worksheet on human growth and development for fifth-grade students. The worksheet was rated very valid by content, media, and language experts (mean 94.7%) and very practical by teachers (95.3%) and students (90.0%). Observation and interviews indicated that it encouraged discussion, questioning, and the expression of ideas, although some students needed teacher scaffolding to interpret instructions and draw conclusions. The study's main contribution is a worked example of how a local cultural artefact, the Besurek motif, can anchor a six-phase inquiry sequence aligned with science literacy competencies in elementary science. Teachers can use the worksheet as a contextual resource in IPAS lessons, and further research should examine its effectiveness in improving science literacy through controlled pre-test-post-test designs in a wider range of schools.

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Conflict of Interest

The third author developed the BESURReK learning model (Asmara, 2024) on which the worksheet is based. The authors declare no other financial or non-financial conflict of interest.

Author Contributions

Diyoba Azhar Fuadi: conceptualization, methodology, investigation, data curation, formal analysis, writing-original draft. Merri Sri Hartati: methodology, supervision, writing-review and editing. Adi Asmara: conceptualization, supervision, writing-review and editing.

Generative AI Disclosure

Generative AI (Claude, Anthropic) was used to assist in restructuring the thesis into article format, translating it into English, and editing the language. The authors reviewed and verified all content, data, and references and take full responsibility for the final manuscript.

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