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Designing JUMPISA: A PISA-Based Jumping Task to Support Students' Statistical Literacy using Jambi Context

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Abstract

Statistical literacy is a critical competence for 21st-century students, yet many struggle to apply statistical concepts in authentic contexts. This study reports the development of JUMPISA, a PISA-based Jumping Task contextualized for secondary students in Jambi Province, designed to enhance students' abilities to interpret, represent, and reason with data. Employing a design research approach with iterative development, the study included preliminary and formative evaluations to assess task validity and feasibility. The JUMPISA tasks integrate content on uncertainty, work-related contexts, and varying reasoning levels in line with PISA's framework. Results indicate that students demonstrated notable improvement in engaging with authentic statistical problems. Beyond practical effectiveness, this study advances the theoretical understanding of context-sensitive PISA Task design, showing how locally contextualized, inquiry-driven tasks can be systematically developed and validated for international assessment. JUMPISA exemplifies a model for aligning global assessment frameworks with local educational contexts, offering guidance for both researchers and practitioners in designing assessment-informed instructional activities.

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INTRODUCTION

In today's data-driven world, the ability to understand and critically evaluate statistical information is essential for informed decision-making (Gal, 2002, 2019). Statistical literacy equips individuals to interpret data accurately, assess uncertainty, and make reasoned judgments across civic, economic, and personal contexts (Sharma, 2017). As data increasingly influences policies, media narratives, and everyday life, this competence extends beyond specialists, becoming a foundational skill for navigating complex societal issues (Büscher, 2022; Monteiro & Carvalho, 2023). Developing statistical literacy entails moving beyond computational proficiency to understanding the social and contextual significance of data.

Therefore, fostering these skills within education is crucial to prepare students to engage meaningfully with real-world challenges.

Statistical literacy encompasses a broad set of competencies, including the ability to read and interpret graphs and tables, assess the credibility of data-based claims, and draw sound, evidence-based conclusions (Setiawan & Sukoco, 2021). Ünal and Çil (2023) highlight these skills as essential within 21st-century education, while Muñiz-Rodríguez et al. (2020) stress the importance of connecting statistical concepts to real-world contexts. The OECD (2019) further asserts that cultivating statistical literacy is key to preparing informed and responsible citizens. Moreover, Utari et al. (2025a) note that mastery of statistical terminology and sensitivity to contextual nuances are critical for extracting meaningful insights from data. In addition, Guven et al. (2021) and Utari et al. (2025b) emphasize reflective thinking and evidence-based reasoning as integral components of statistical literacy, both in educational and professional environments.

Despite the recognized importance of statistical literacy, effectively fostering it in classrooms remains a significant challenge. Widjaja (2012) notes that students often focus on procedural aspects of statistics without understanding their conceptual foundations. Similarly, Callingham and Watson (2023, 2017) highlight the cognitive difficulty students face when engaging in higher-order statistical thinking, such as drawing inferences and evaluating arguments. Johannssen et al. (2021) and Delport (2023) also report that interpreting data in open-ended, context-rich situations remains a persistent obstacle. Hasanah et al. (2024) therefore call for the implementation of robust, context-based teaching strategies that help students move beyond surface-level calculations toward deeper engagement with data.

One promising approach to promoting higher-order thinking is the use of jumping tasks—problem-solving activities designed to push students beyond routine exercises and encourage critical reasoning. Research by Putri and Zulkardi (2019) and Hobri, Ummah, et al. (2020) shows that jumping tasks help students tackle complex problems, foster active participation, and stimulate thoughtful inquiry. According to Sato (2012, 2014) and Sato and Sato (2003), such tasks demand greater intellectual effort, prompting collaboration and the development of more sophisticated problem-solving skills.

Unlike basic sharing tasks, which tend to focus on the exchange of surface-level ideas, jumping tasks require students to construct meaning through dialogue and negotiation (Putri & Zulkardi, 2019). Studies by Asari (2017) and Sari and Putri (2020) confirm that jumping tasks foster meaningful collaboration. Within the Lesson Study for Learning Community (LSLC) framework, Sato (2012) emphasizes the importance of guiding students progressively from simple to complex tasks. When integrated effectively into instruction, jumping tasks can cultivate analytical and creative thinking while pushing students beyond their comfort zones (Hobri, Ummah, et al., 2020; Tanujaya et al., 2023).

In the context of international assessments, the Programme for International Student Assessment (PISA) provides a comprehensive framework for evaluating and developing students' statistical literacy worldwide (OECD, 2023). PISA-based tasks emphasize real-world application, data interpretation, and critical thinking, making them ideal tools for enhancing statistical understanding (Pratiwi et al., 2019). However, a persistent challenge lies in adapting these standardized tasks to local settings, where cultural and environmental contexts significantly influence students’ engagement with data (Nusantara et al., 2021b, 2024).

In Indonesia—specifically in Jambi Province—this challenge also presents a unique opportunity. The region’s cultural richness and local issues can serve as authentic, relevant contexts for teaching statistics. Several studies (e.g., Iswari et al., 2025; Lusiana et al., 2025; Lusinda et al., 2025) show that using local data sources increases student engagement and helps them connect abstract statistical ideas to real-life experiences. Contextualized instruction has been shown to support deeper understanding, enhance motivation, and foster meaningful learning (Nusantara et al., 2020; Utari et al., 2024).

This study introduces JUMPISA—an instructional tool that integrates Jumping Tasks with the PISA framework, contextualized for Jambi Province. JUMPISA is designed not only to engage students with complex, real-world problems but also to align explicitly with PISA item construction principles, including domain (statistical content), process (interpreting, representing, reasoning), context (authentic local scenarios), and item characteristics (cognitive demand and reasoning level) (OECD, 2019). By incorporating key features of Jumping Tasks—such as cognitive jumps that provoke reflection and collaborative negotiation to construct knowledge—JUMPISA operationalizes these PISA principles into a structured yet inquiry-driven learning experience. This integrative approach ensures that JUMPISA functions as a theoretically grounded innovation, bridging global assessment standards with local contexts while fostering both conceptual understanding and practical application in statistics (Zulkardi & Putri, 2020).

Although previous research has explored the utilization of Jumping Tasks in learning (Hobri, Tussolikha, et al., 2020; Putri & Zulkardi, 2018) and the development of PISA-based learning (Nusantara et al., 2021b; Zulkardi & Putri, 2020), there remains limited investigation into how these educational tools can be systematically integrated and localized for specific cultural contexts such as Jambi. Principles of situational validity (OECD, 2019) and context authenticity (Stacey, 2011) underscore the importance of designing tasks that are both culturally and contextually meaningful, thereby supporting student engagement and ensuring valid assessment of statistical literacy. Addressing this gap, the present study aims to develop JUMPISA, a contextualized instructional tool that combines PISA-based tasks with the Jumping Task using the Jambi context, ensuring that the resulting product is valid, practical, and has the potential effect to support students’ statistical literacy.

RESEARCH METHODS

This section describes the research methods used in this study, including the research design, research subjects, implementation procedures, data collection techniques, and data analysis steps.

Research Design

This study employed a design research methodology, specifically a development studies type (Bakker, 2018). The research followed two main phases: the preliminary phase and the formative evaluation phase, as suggested by Tessmer (2013) and Zulkardi (2002). The formative evaluation was further divided into several stages: self-evaluation, one-to-one evaluation (1-1 activity), expert review, small group testing, and field testing.

Importantly, each stage of formative evaluation was designed to examine the alignment of JUMPISA prototypes with PISA Task constructs. The evaluation focused on four key elements: Content (uncertainty and data), Process (interpreting, representing, reasoning), Context (authentic, work-related or local contexts), and Cognitive Level (multiple reasoning levels as per PISA framework). This approach ensured that the design not only reflected local relevance but also adhered to international assessment principles.

Research Subject

This study involved eighth-grade students from Secondary School Number 4 (SMPN 4) in Kota Jambi during the even semester. The one-to-one (1-1 activity) included three students, whereas the small group phase consisted of six students who were not part of the main research sample. The field testing phase was conducted with 34 students, representing the primary subjects of the research. Participant selection was guided by teacher recommendations, taking into account their consistent academic performance.

Research Procedure

The research followed a two-phase design research approach—preliminary and prototyping—incorporating formative evaluations throughout (see Figure 1).

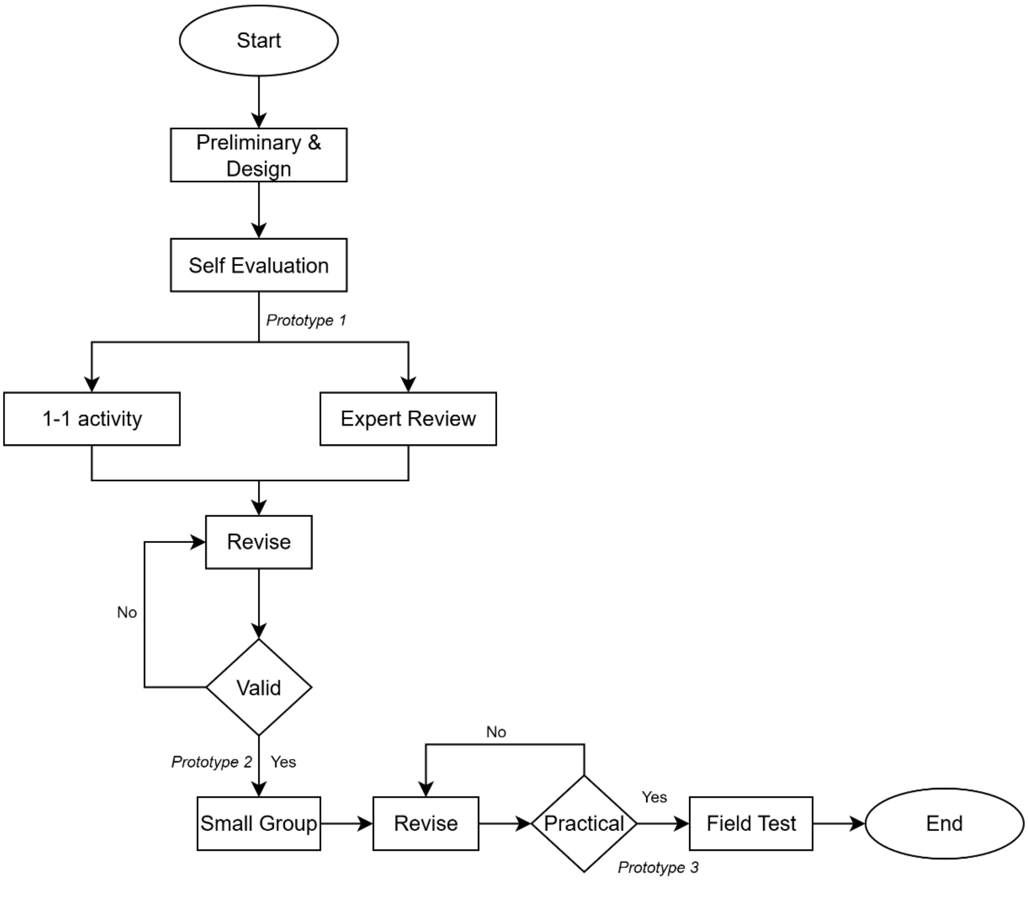


Figure 1. Flow Chart of JUMPISA Development in the Context of Jambi

In the preliminary and design phase, the research location was selected, and participants were chosen by the researchers. An in-depth analysis was conducted focusing on the characteristics of the students, the curriculum content, and relevant items from the PISA assessment. This preparatory work resulted in the development of the initial draft of JUMPISA, referred to as Prototype I.

During the prototyping phase, an iterative process was followed, involving several steps such as self-evaluation, simultaneous 1-1 activity and expert review, small group trials, and finally, a field test. The researchers began by internally reviewing Prototype I to verify its consistency with the PISA framework, paying particular attention to the accuracy of content, contextual appropriateness, and anticipated difficulty levels. Subsequently, the prototype was evaluated by a panel of three experts: two university lecturers specializing in the development of PISA-based tasks and a mathematics teacher with classroom experience. Their evaluation focused on content validity and relevance to the local context. In parallel, the prototype underwent 1-1 testing with three students outside the primary sample, each representing different academic performance levels, to gather preliminary feedback and suggestions. These inputs led to refinements that produced Prototype II. Prototype II was then tested with a small group of six students recommended by their teachers, chosen to represent diverse academic abilities. This stage aimed to assess the prototype’s clarity and practical application, leading to further adjustments and the creation of Prototype III. Finally, Prototype III was administered to the main research group, consisting of 34 eighth-grade students from class VIII A. The students’ responses were analyzed to determine how effectively JUMPISA, contextualized within Jambi, supported the enhancement of their statistical literacy skills.

Data Collection

Data collection was carried out using interviews, tests, and questionnaires. Interviews took place during the 1-1 activity and small group phases to gather insights into students’ responses during working with JUMPISA. Tests were administered during the field test phase to measure the potential effectiveness of the developed JUMPISA. Meanwhile, questionnaires were distributed to expert validators during the review process to assess validity, as well as to students during the one-on-one and small group phases to evaluate the practicality of the developed JUMPISA.

Data Analysis

The study utilized both qualitative and quantitative approaches in analyzing the data. Quantitative data were obtained from expert validation scores, questionnaire responses, and the results of student assessments. In contrast, qualitative data were drawn from expert feedback and interview transcripts. To assess the validity of the JUMPISA—particularly those addressing the "uncertainty and data" domain—expert input was used to inform revisions. This validation process included both qualitative elements, such as detailed comments and recommendations, and quantitative measures collected through structured scoring instruments. The effectiveness of the developed tasks was evaluated by analyzing students’ test responses, which provided insights into their proficiency in statistical literacy.

RESULTS AND DISCUSSION

The research results are presented in the preliminary and design phase as well as in the prototyping phase.

Preliminary and Design

The preliminary phase of this study consisted of two main components: the preparation stage and the design stage. The study was conducted at SMPN 4 in Kota Jambi in class VIII.A.

A preliminary analysis of student characteristics was carried out, focusing on their mathematical abilities. This analysis targeted all 34 students in class VIII.A, who were selected as the trial group for the study. Initial classroom observations revealed that the students' levels of statistical literacy varied significantly. This diversity suggests a broad range of proficiency, highlighting the need for instructional tools that can address multiple competency levels within a single classroom.

In terms of curriculum, SMPN 4 Kota Jambi implements the "Kurikulum Merdeka" (Independent Curriculum-IC), which also aligns with the curriculum used by senior high school teachers across the Jambi Province—particularly those involved in developing JUMPISA in the domain of uncertainty and data. Therefore, the learning objectives and task indicators used in this study were aligned with the learning outcomes outlined at the end of Phase D of the IC (See Table 1).

Table 1. The result of IC analysis

Element	Learning Outcomes
Data Analysis and Probability	By the end of Phase D, students are expected to be able to formulate questions, collect, present, and analyze data to answer those questions. They are capable of utilizing bar charts and pie charts to effectively present and interpret data.

As part of the item development process, the researcher analysed existing PISA problems (not officially used), particularly those from the 2009 PISA assessment, which included tasks related to population distribution in Indonesia (see Figure 2). These items served as references for contextual adaptation.

Furthermore, the mathematical processes embedded in the tasks were analyzed, with reasoning identified as the target process. Drawing on the formulate–employ–interpret (FEI) cycle in the PISA framework (OECD, 2019), the developed JUMPISA task was classified as Level 4. This classification is supported by several cognitive indicators. During the formulate stage, students identified relevant variables and translated real-world data into appropriate mathematical representations. In the employ stage, they selected and constructed suitable representations (e.g., bar charts, line graphs) while applying proportional reasoning to identify emerging patterns. Finally, in the interpret stage, students articulated conclusions connected to the given context, demonstrating reasoning that extended beyond routine procedural application.

In comparison, Level 3 tasks typically require the application of standard procedures to familiar problems, whereas the JUMPISA task involved multi-step reasoning and the flexible use of multiple representations. However, it did not reach Level 5, which usually demands abstraction or synthesis across models. Therefore, the Level 4 classification accurately captures the equilibrium between cognitive complexity, reasoning depth, and contextual interpretation embedded in the JUMPISA design.

MATHEMATICS EXAMPLE 25: INDONESIA

Indonesia lies between Malaysia and Australia. Some data of the population of Indonesia and its distribution over the islands is shown in the following table:

Region	Surface area (km)	Percentage of total area	Population in 1980 (millions)	Percentage of total population
Java/Madura	132 187	6.95	91 281	61.87
Sumatra	473 606	24.86	27 981	18.99
Kalimantan (Borneo)	539 460	28.32	6 721	4.56
Sulawesi (Celebes)	189 216	9.93	10 377	7.04
Bali	5 561	0.30	2 470	1.68
Irian Jaya	421 981	22.16	1 145	5.02
TOTAL	1 905 569	100.00	147 384	100.00

One of the main challenges for Indonesia is the uneven distribution of the population over the islands. From the table we can see that Java, which has less than 7% of the total area, has almost 62% of the population.

Source: de Lange and Verhage (1992). Used with permission.

Question 1: INDONESIA

Design a graph (or graphs) that shows the uneven distribution of the Indonesian population.

Figure 2. Inspiration for the developed JUMPISA

In the design stage, the researcher developed a test specification table (blueprint) that included elements of the PISA framework, relevant learning outcomes, and task indicators. Based on this blueprint, the researcher constructed the JUMPISA by writing open-ended questions aligned with the specified indicators.

In addition, a scoring rubric was created to guide the assessment of student responses, including detailed answer keys for each question. This rubric was designed to ensure consistency and objectivity in evaluating students' performance on open-ended, constructed-response tasks.

The outcome of this stage was the initial version of a JUMPISA focusing on the content domain of uncertainty and data. The JUMPISA was contextualized using the data of high school teachers in Jambi Province and was designated as Prototype I.

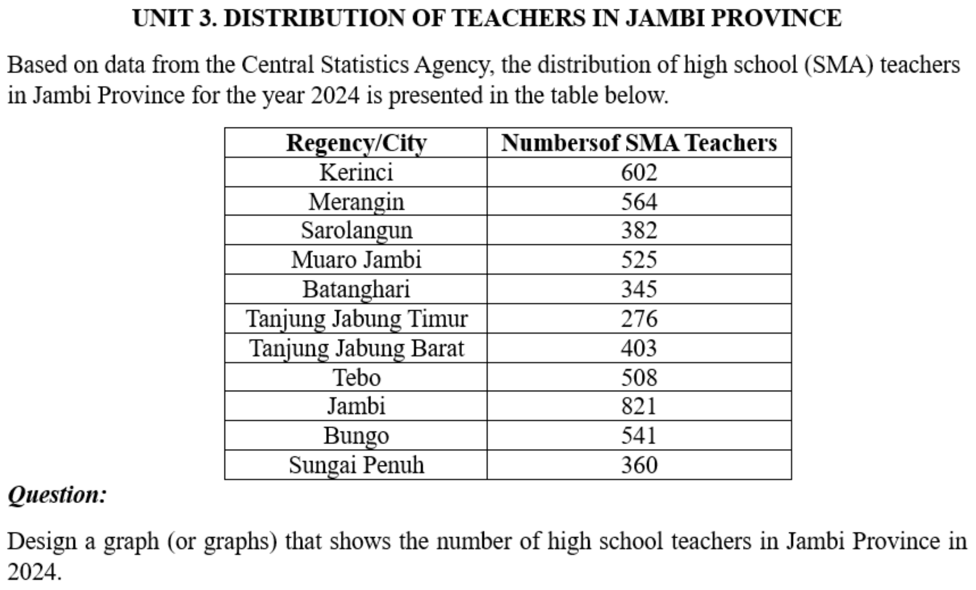
Prototyping

The prototyping phase followed a formative evaluation cycle, which consisted of several stages: self-evaluation, expert review, one-to-one evaluation, small group testing, and field testing. Each stage served to refine and validate the developed instructional task, ensuring its alignment with the research objectives and educational standards.

Self-Evaluation

In the self-evaluation stage, the researcher conducted an internal review of Prototype I using the PISA framework, focusing on content accuracy, contextual relevance, and cognitive demand. This critical review led to refinements aimed at enhancing clarity and alignment with Level 4 proficiency standards, particularly within the uncertainty and data domain. The resulting Prototype I was designed to engage students in constructing and interpreting diagrams that represent statistical data relevant to Jambi Province high school teachers, thereby grounding the tasks in authentic local contexts (see Figure 3).

Figure 3 presents the initial design of JUMPISA within the context of high school teachers in Jambi Province. This task is situated in the domain of uncertainty and data and highlights the critical mathematical process of interpreting and applying conceptual knowledge. Students are required to construct multiple diagrams representing the number of high school teachers in Jambi Province in 2024. Classified as a Level 4 item according to the PISA framework, this task demands that students engage deeply in the interpretation of data through spatial visualization techniques as part of their problem-solving strategy or determine how to utilize simulations to collect appropriate data. At this proficiency level, students are expected not only to interpret and integrate representations from diverse information sources but also to provide reasoned justifications grounded in these interpretations. Furthermore, the task requires making conditional decisions, including the use of two-way tables, to support their analytical conclusions.



UNIT 3. DISTRIBUTION OF TEACHERS IN JAMBI PROVINCE

Based on data from the Central Statistics Agency, the distribution of high school (SMA) teachers in Jambi Province for the year 2024 is presented in the table below.

Regency/City	Numbersof SMA Teachers
Kerinci	602
Merangin	564
Sarolangun	382
Muaro Jambi	525
Batanghari	345
Tanjung Jabung Timur	276
Tanjung Jabung Barat	403
Tebo	508
Jambi	821
Bungo	541
Sungai Penuh	360

Question:

Design a graph (or graphs) that shows the number of high school teachers in Jambi Province in 2024.

Figure 3. Prototype I of JUMPISA using Jambi context

Expert Review

The expert review phase yielded valuable comments and suggestions on Prototype I. These inputs were provided with respect to the content, construct, and language aspects of the task. The detailed feedback from the validators is summarized in Table 2.

Three experts—two university lecturers with extensive experience in PISA task development (each having designed PISA-like tasks for over a decade and participated in OECD-aligned workshops) and one experienced mathematics teacher with more than 15 years of teaching and prior involvement in national assessment item design—evaluated Prototype I, focusing on content validity, construct validity, and language clarity.

Table 2 and Table 3 summarizes their feedback quantitatively (e.g., mean ratings) and qualitatively. In addition to numerical scores, an analysis of expert comments revealed key areas for improvement: (1) Instruction clarity—experts suggested replacing ambiguous phrases like “create a graph or several graphs” with the more precise “create a diagram”; (2) Formatting consistency—ensuring that all questions end with a period and that terminology aligns with PISA conventions; (3) Contextual relevance—experts confirmed that tasks were meaningful within the Jambi context but recommended minor adjustments to localize names and scenarios further; and (4) Cognitive demand alignment—experts noted that some items could better scaffold the reasoning steps to match the intended Level 4 classification.

Table 2. Validation scores by expert review

Validator	Comments and Suggestions	Revision Decisions
Validator 1	1. The question "create a graph or several graphs" was changed to "create a pie chart and a bar chart." 2. The question was revised to simply say "create a diagram." 3. The question ends with a period, consistent with the original PISA item format. 4. A source link was added for the bar chart.	1. Question revised to "create a diagram." 2. Added a period at the end of the question. 3. Included source link for the bar chart.
Validator 2	1. The question ends with a period, consistent with original PISA items. 2. Added a source link for the bar chart. 3. The question "create a graph or several graphs" was changed to "create a diagram."	1. Added a period at the end of the question. 2. Included source link for the bar chart. 3. Question revised to "create a diagram."

Following this, the validators completed a questionnaire designed to evaluate the prototype of JUMPISA. This questionnaire aimed to assess the overall quality of the tasks based on the same three aspects: content, construct, and language. It consisted of 17 items in total. The outcomes of this validation process, reflecting the experts’ evaluations, are summarized in Table 3.

Table 3. Validators’ feedback categorized by content, construct, and language

No	Validator	Score Obtained	Maximum Score	Percentage (%)
1	Validator 1	70	85	82,3
2	Validator 2	58	85	68,2
3	Validator 3	73	85	85,8
	Average Percentage			78,7
	Category			Valid

As shown in Table 3, the prototype received an average score of 78.7%, placing it in the "Valid" category according to established thresholds (Iswari et al., 2025). This validation supports the appropriateness of the task for assessing statistical literacy in junior secondary students.

1-1 Activity

During the one-to-one evaluation stage, feedback was collected from three students who interacted individually with Prototype I. Their responses and comments were used to identify areas where the task could be improved, particularly in terms of clarity and accessibility. The detailed feedback and the corresponding revision decisions are presented in Table 4.

Table 4. Student comments and responses during the one-to-one evaluation

Student	Comment and Suggestion	Revision Decision
Student 1	The student had difficulty constructing a pie chart	The task instruction was revised to "create a diagram".
Student 2	No comments or suggestions were provided	No revisions necessary
Student 3	The student had difficulty constructing a pie chart and struggled with creating a bar chart.	Considered simplifying or clarifying instructions.

As shown in Table 4, the most common difficulty reported by students was related to constructing pie and bar charts. Based on this feedback, the wording of the task instruction was revised from "create a pie chart and a bar chart" to the more general "create a diagram" to allow greater flexibility in student responses and reduce cognitive load during the initial trials.

The researcher further substantiated the students' difficulties through interviews conducted during the one-to-one phase. The following excerpt illustrates a typical exchange between the researcher (R) and a student (S).

R : *Which question did you find most difficult?*
S : *I think the most difficult one was the task that involved using and creating a pie chart.*
R : *Why was it difficult for you to construct a pie chart?*
S : *Because I don't really understand how to calculate the percentages or how to convert them into degrees for the circle segments*

This interview confirmed that the student experienced difficulties in both interpreting and constructing pie charts, particularly in calculating the proportions and translating them into angular measurements.

After completing the task in the one-to-one phase, students were asked to fill out a validity questionnaire aimed at evaluating the clarity and appropriateness of the content—particularly whether the instructions were understandable and aligned with the learning objectives. The outcomes of this assessment are summarized in Table 5.

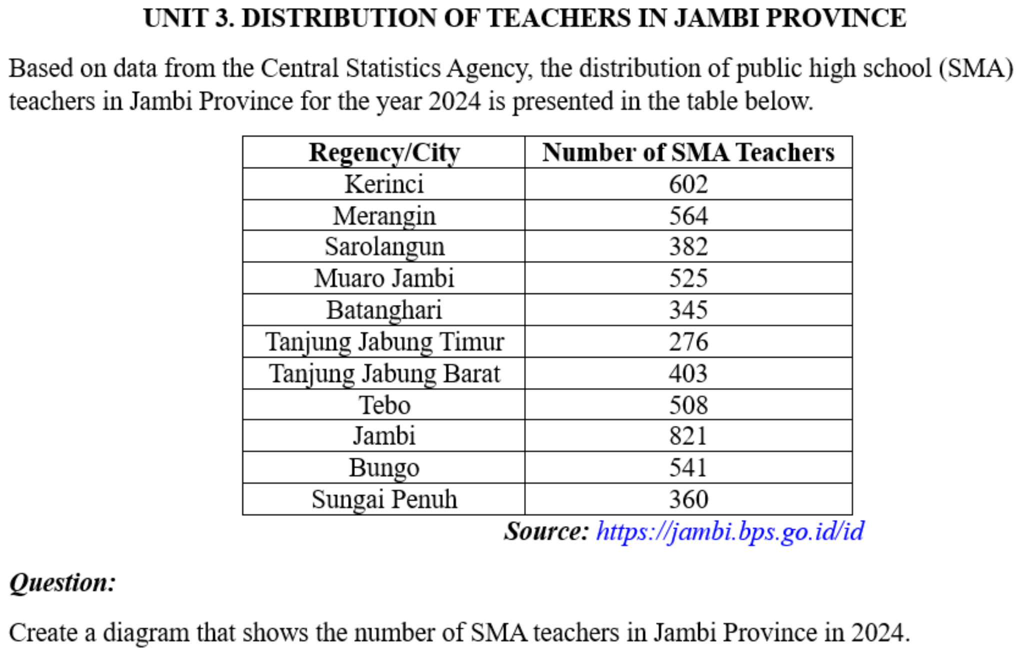
Table 5 presents the results of the validity assessment conducted during the one-to-one evaluation stage. The average score obtained was 78.5%, which falls within the "Valid" category according to established thresholds (Iswari et al., 2025). This suggests that the task was judged to be appropriate in terms of content relevance, clarity, and alignment with learning objectives. In other words, students were able to understand the material, and it was considered suitable for use in the learning process. Following the revision decisions outlined in Tables 3 and 5, the researcher made improvements to the task. The revised version was then prepared for the next phase, which involved evaluation by a small group.

Table 5. Results of the validity questionnaire of the developed JUMPISA

No	Student	Score Obtained	Maximum Score	Percentage (%)
1	Student 1	56	70	80
2	Student 2	52	70	74,2
3	Student 3	57	70	81,4
	Average Percentage			78,5
	Category			Valid

Small Group

Based on the revisions made to the draft JUMPISA according to the feedback and suggestions received during the expert review and one-to-one phases, Prototype II was developed and subsequently tested with students in the small group phase.



UNIT 3. DISTRIBUTION OF TEACHERS IN JAMBI PROVINCE

Based on data from the Central Statistics Agency, the distribution of public high school (SMA) teachers in Jambi Province for the year 2024 is presented in the table below.

Regency/City	Number of SMA Teachers
Kerinci	602
Merangin	564
Sarolangun	382
Muaro Jambi	525
Batanghari	345
Tanjung Jabung Timur	276
Tanjung Jabung Barat	403
Tebo	508
Jambi	821
Bungo	541
Sungai Penuh	360

Source: *https://jambi.bps.go.id/id*

Question:

Create a diagram that shows the number of SMA teachers in Jambi Province in 2024.

Figure 4. Prototype II of Developed JUMPISA using Jambi Context

During this phase, Prototype II was administered to a group of six students with varying levels of mathematical ability. The students were allotted 120 minutes to complete the JUMPISA. Throughout the task completion process, the researcher carefully recorded any questions raised by the students regarding the tasks and conducted interviews to gather their responses, comments, suggestions, and to identify any difficulties encountered.

While most students demonstrated a clear understanding of the task instructions, some struggled to answer correctly due to gaps in prior knowledge and unfamiliarity with the PISA-like question format. Despite these challenges, the researcher decided that no further revisions were necessary, and the prototype would be retained in its current form.

Table 6. The result of the practicality of the developed JUMPISA

No.	Student	Score Obtained	Maximum Score	Percentage (%)
1	CMR	62	70	88,5
2	IEP	58	70	82,8
3	CAH	42	70	60
4	EMP	55	70	78,5
5	RR	69	70	98,5
		Average		84,5
		Category		Highly Practical

Table 6 shows that the practicality questionnaire results from the small group phase yielded an average score of 84,5%, placing the tasks in the "Highly Practical" category according to established thresholds (Iswari et al., 2025). This classification indicates that the developed tasks were well-received by the students in terms of content presentation, language clarity, and functional usability.

Field Test

In the field test phase, the developed JUMPISA (see Figure 4) was administered to 26 students from class VIII.A at SMPN 4 Kota Jambi. Below are selected student responses to the Unit 3 questions.

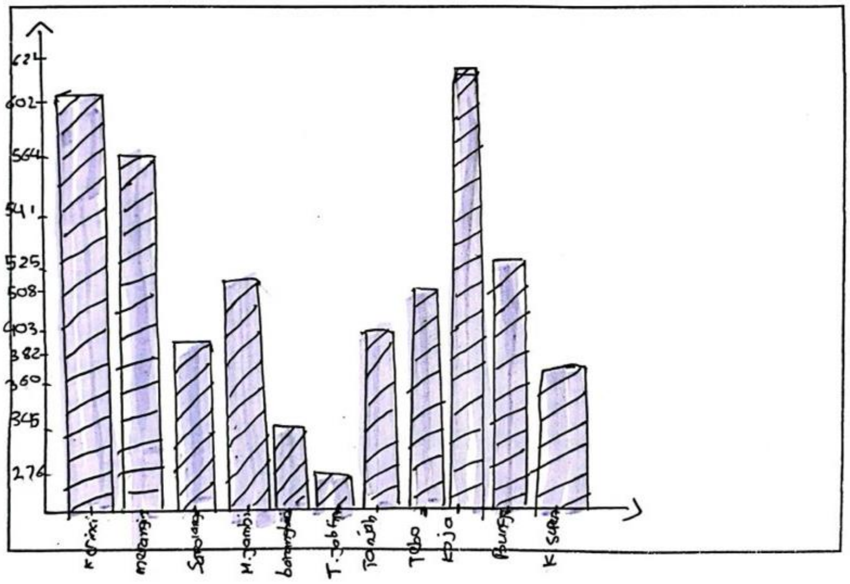


Figure 5. ZA's response to the JUMPISA using Jambi context

As illustrated in Figure 5, ZA demonstrates an emerging ability to transform real-world data into a structured and interpretable visual format using a bar chart. This transformation from raw data to graphical representation reflects an initial development of key mathematical competencies, particularly in data representation and the use of mathematical tools. ZA's response aligns with the cognitive process of representing, as they successfully organize raw data into a visual form. However, a misconception appears in interpreting the vertical (Y-axis) variable representing the number of teachers. Specifically, the Y-axis intervals do not correspond to a consistent numerical scale but instead reflect a simple ordinal ordering from low to high. This indicates partial engagement in the interpreting process, as ZA can read the graph in a general sense but does not fully apply quantitative reasoning to evaluate the magnitude of differences. Overall, ZA's response illustrates an early stage of statistical reasoning competency, showing proficiency in representing data while highlighting the need for scaffolding in interpreting and evaluating quantitative information. This understanding is further supported by the student's interview. (Note: ZA: Student, UL: Researcher)

UL : *Can you explain how you determined the heights of the bars on your chart?*
ZA : *I just arranged them from the lowest number of teachers to the highest. I didn't use a specific scale, I just made the bars taller if there were more teachers.*
UL : *Did you consider using equal spacing on the Y-axis to show the differences in values?*
ZA : *No, I didn't think about the spacing. I only wanted to show which had more and which had less.*

This excerpt highlights ZA's partial understanding of graphical representation. While the student recognizes the need to differentiate quantities visually, the lack of proportional scaling on the Y-axis suggests limited understanding of how scale and interval affect the accuracy of data representation. The response reflects an intuitive rather than analytical approach to constructing graphs, which, although indicative of developing representational skills, still lacks the precision required for accurate quantitative communication. This aligns with early-stage statistical literacy, where students are beginning to engage with data but require further scaffolding to interpret and construct representations appropriately.

Figure 6 illustrates QKS's emerging competence in organizing real-world data into a bar chart, reflecting proficiency in the representing process of statistical reasoning. QKS correctly structured the chart from smallest to largest values and established measurable intervals on both axes, demonstrating attention to scale and variation. However, a misconception occurred when the axis labels were sequentially numbered without aligning to the established intervals, indicating partial engagement in the interpreting stage. While QKS can read and organize the data, accurately evaluating quantitative differences remains challenging. Overall, QKS's response highlights developing statistical reasoning skills, with strength in data representation but a need for scaffolding to improve interpretation and evaluation. This understanding is further supported by interview insights. (Note: QKS: Student, UL: Researcher)

UL : *How did you decide where to place the numbers on your axes?*
QKS : *I made the spaces equal on the axes, but then I just put the numbers in order from smallest to biggest without matching them exactly to the spaces.*

UL	:	*Do you think the numbers should reflect the actual distances according to the scale?*
QKS	:	*I wasn't sure. I thought as long as the numbers go up in order, it's fine.*

The interview reveals that while QKS demonstrates awareness of the need for consistent spacing and starting the graph at zero, there remains a conceptual gap in accurately matching numeric labels to their corresponding positions on the scale. This indicates an emerging but incomplete understanding of how scales function in graphical representations. QKS's approach, prioritizing ordinal placement over proportional accuracy, suggests that the student is still developing a nuanced grasp of measurement and scale interpretation—an essential aspect of statistical literacy and effective data communication.

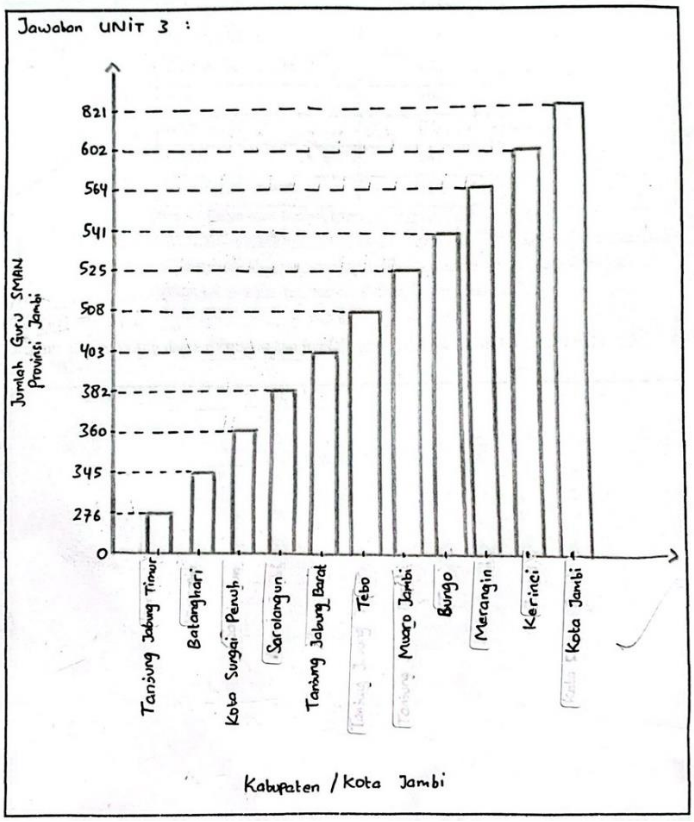


Figure 6. QKS's response to the JUMPISA using Jambi context

To provide an overview of students' abilities in representing and interpreting data, five representative responses to the JUMPISA tasks are summarized in Table 7. Table 7 highlights the type of student, type of graph chosen, the students' demonstrated strengths, and the misconceptions or limitations observed during the task and follow-up interviews.

Table 7 illustrates varying levels of emergent statistical literacy among the students. Student I and Student III are primary examples analyzed in depth, showing early development of representational skills but differing in attention to proportional accuracy and scale. Student II and Student IV demonstrate alternative approaches—line graph and pictogram respectively—that highlight procedural fluency and attempts to convey data differentiation, yet both reveal conceptual gaps. Student V represents incomplete responses, which underscores that some students require additional support and scaffolding to engage fully with data representation tasks. Collectively, these responses indicate that while students are beginning to engage meaningfully with data, targeted instruction is necessary to strengthen understanding of scale, proportionality, and the purpose-driven selection of graphical representations. This summary provides a concise view of student competencies and challenges, supporting the argument that contextually grounded, inquiry-based tasks can reveal both strengths and limitations in developing statistical literacy.

Table 7. Descriptions of students' responses to the JUMPISA tasks

Student Type	Graph Type	Strengths	Misconceptions/Limitations
I	Bar chart	Able to transform raw data into a visual format; recognizes need to differentiate quantities	Misunderstands Y-axis scale; uses ordinal rather than proportional heights; intuitive rather than analytical approach
II	Line graph	Correct interval usage on axes; procedural fluency	Does not understand origin point; choice of graph based on aesthetics; lacks conceptual distinction between line and bar graphs
III	Bar chart	Origin at zero; consistent intervals; sequential data organization	Numeric labels do not match intervals; ordinal placement prioritized over proportional accuracy
IV	Pictogram	Selected unit (1 star = 50 teachers) to enhance differentiation; emerging sense of scale	Difficulty representing non-whole units; limited understanding of fractional/partial data representation
V	Incomplete/ No graph	Attempted the task but did not complete	Insufficient data for analysis; response could not be evaluated for statistical literacy

The findings of this study highlight the effectiveness of integrating Jumping Tasks with PISA-based problem design through JUMPISA in developing students' statistical literacy. Students demonstrated varying levels of proficiency in data representation, interpretation, and reasoning while engaging with authentic, contextually meaningful problems, showing that statistical literacy extends beyond mere computational skills to include critical data analysis and contextual understanding (Gal, 2002, 2019; Monteiro & Carvalho, 2023; Sharma, 2017).

A central factor in achieving these outcomes was the iterative design process, which refined the tasks systematically based on self-evaluation, expert review, and field testing. These refinements improved the clarity of instructions, standardized formatting, and enhanced contextual relevance. For example, revising ambiguous prompts such as "create a graph or several graphs" into the more precise "create a diagram" enabled students to interpret data more accurately. This iterative process revealed several key design principles: clear and precise instructions support interpretive reasoning; consistent visual and textual formatting helps maintain cognitive focus on the problem rather than procedural confusion; contextual authenticity increases engagement and relevance; and scaffolded cognitive demand allows students to progress from representing to interpreting and evaluating data effectively. Moreover, these tasks encouraged reflective thinking and evidence-based reasoning, competencies essential for success in the complex demands of the 21st century (Guven et al., 2021; Ünal & Çil, 2023; Utari et al., 2025b). Collectively, these results demonstrate that JUMPISA not only aligns with international PISA standards but also fosters robust statistical reasoning in a manner that is meaningful and relevant to the students' local context.

During the 1-1 and small group trials, some students struggled with pie charts and percentage calculations, despite these being basic skills. This mirrors previous research showing that students often have trouble linking statistical procedures with deeper conceptual understanding, particularly when faced with open-ended and unfamiliar problems (Callingham & Watson, 2023, 2017; Delport, 2023; Widjaja, 2012). The mental effort required by these tasks, coupled with students' limited exposure to real-life data contexts, can hinder engagement (Hasanah et al., 2024; Johannssen et al., 2021). However, after adjustments informed by expert and learner feedback, the tasks' practicality ratings increased, supporting the idea that well-designed, contextually relevant materials improve usability and clarity (Muñiz-Rodríguez et al., 2020; Setiawan & Sukoco, 2021; Utari et al., 2025a).

In the broader field testing, students showed greater skill in representing data and using mathematical tools, which are key components in the PISA framework (OECD, 2019; Pratiwi et al., 2019; Zulkardi & Putri, 2020). For example, some students effectively converted raw data into clear graphical forms like bar and line charts, helping them see patterns and draw meaningful conclusions. This confirms the view that statistical literacy involves interpreting and critically evaluating data from different sources (Büscher, 2022; Gal, 2019; Monteiro & Carvalho, 2023).

However, persistent challenges emerged concerning students' graphical data representation skills (bar and line charts) and interpreting scales on bar and line graphs. These difficulties corroborate Setiawan and Sukoco's (2021) findings that learners in early stages of statistical literacy often struggle with conceptual foundations like proportional reasoning and appropriate scale use. Additionally, some students' tendency to select graph types based on aesthetic preference rather than functional suitability reflects a conceptual gap, consistent with observations by van Dijke-Droogers et al. (2022).

The consistent presence of higher-order cognitive skills such as reasoning, data representation, and applying knowledge in context suggests that JUMPISA aligns well with both national curricula and international standards like PISA (Nusantara et al., 2021b; OECD, 2023; Utari et al., 2024). By situating tasks in local contexts—for example, issues surrounding teacher distribution in Jambi—this approach supports findings that contextualizing learning materials boosts student motivation and achievement (Iswari et al., 2025; Lusinda et al., 2025; Nusantara et al., 2020). This local adaptation helps bridge the gap between global assessment frameworks and local classroom realities (Nusantara et al., 2021a, 2024; Zulkardi & Putri, 2020).

Although some students encountered difficulties due to limited prior knowledge and unfamiliarity with open-ended inquiry tasks, the JUMPISA illustrates how intentionally introducing cognitive conflict can foster deeper learning.This aligns with previous studies highlighting that the transition from procedural fluency to conceptual understanding requires sustained instructional support (Callingham & Watson, 2023; Delport, 2023; Widjaja, 2012). By challenging students to confront discrepancies in their thinking, the task encourages dialogue, reflection, and collaborative knowledge construction (Cayetano & Ibarra, 2024; Hobri, Tussolikha, et al., 2020; Putri & Zulkardi, 2019; Sari & Putri, 2020; Sato, 2012, 2014), supporting the transition from procedural fluency toward conceptual understanding and promoting the development of more robust statistical literacy.

Overall, these results suggest that JUMPISA is a promising instructional activity that effectively combines the rigor of PISA-like assessments with culturally relevant contexts. It addresses the need for tools that are valid, practical, and effective in nurturing statistical literacy across diverse educational settings (Hobri, Tussolikha, et al., 2020; Nusantara et al., 2021c; Utari et al., 2025a). Future research should investigate how this instructional performs across different regions and student groups and explore its long-term effects on students' critical engagement with data both academically and in everyday life.

CONCLUSION

This study resulted JUMPISA, a PISA-based Jumping Task contextualized for Jambi Province, which effectively supports students' statistical literacy in representing, interpreting, and reasoning with data. While some students experienced difficulties with specific concepts, the task demonstrated strong potential to engage learners in authentic, contextually meaningful statistical problems. Beyond confirming empirical outcomes, the study offers theoretical implications for PISA-task design: JUMPISA illustrates how contextualization, when combined with cognitive conflict and scaffolded complexity, can extend PISA-based inquiry approaches to local settings, particularly in developing countries. From the iterative prototyping process, four design principles emerged that are replicable in other contexts: (1) contextualization to relate tasks to students' experiences, (2) cognitive conflict to stimulate deeper reasoning, (3) incremental complexity to scaffold conceptual growth, and (4) multiple representations to support flexible data interpretation. These principles provide a practical framework for designing culturally relevant PISA-like tasks, while future research may further examine JUMPISA's effectiveness across diverse populations and over extended periods to assess the development of robust statistical reasoning and critical data literacy.

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