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VALIDATION OF STATISTICS WORKSHEETS BASED ON *SEREN TAUN* ETHNOMATHEMATICS TO FACILITATE MATHEMATICAL REPRESENTATION SKILLS

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ABSTRACT

Statistics learning requires contextual teaching materials that can help students represent data visually, symbolically, and verbally. However, statistics worksheets used in learning are often procedural and less connected to students' cultural contexts. This study aims to determine the validity of *Seren Taun* ethnomathematics-based statistics worksheets designed to facilitate students' mathematical representation skills. This research employed research and development (R&D) using the ADDIE development model, limited to the analysis, design, and development stages. Preliminary data were collected through literature study and interviews with a mathematics teacher and grade XI students at SMAN 3 Cikarang Utara. Product validation was conducted by material experts, cultural experts, and media experts using validation questionnaires based on a four-point Likert scale. The data were analyzed using descriptive percentage analysis. The results showed that the worksheet obtained validity scores of 96% from material experts, 86% from cultural experts, and 97% from media experts, with an average score of 93% in the very valid category. Therefore, the worksheet is feasible as a contextual learning material to facilitate students' visual, symbolic, and verbal mathematical representation skills in statistics learning.

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1. INTRODUCTION

Statistics is an important topic in school mathematics because it trains students to collect, organize, represent, interpret, and communicate data from real-life situations. Through statistics learning, students are expected not only to perform calculations but also

to understand information presented in various forms, such as tables, diagrams, graphs, symbols, and written explanations. Therefore, statistics learning is closely related to mathematical representation skills, which enable students to express mathematical ideas in visual, symbolic, and verbal forms.

Mathematical representation skills are needed so that students can connect contextual problems with appropriate mathematical models. However, several recent studies indicate that students still experience difficulties in representing mathematical ideas, especially in transforming verbal information into tables, diagrams, graphs, or symbolic forms (Munthe *et al*., 2023; Rohani *et al*., 2025; Ritmayanti *et al*., 2025). A preliminary study conducted at SMAN 3 Cikarang Utara also showed that students had difficulty interpreting statistical data and converting contextual problems into appropriate visual representations. This condition indicates that students need learning materials that can guide them to understand statistics through meaningful and structured activities.

One learning material that can support this need is the Student Worksheet or LKPD. LKPD can help students learn independently through instructions, contextual problems, guided activities, and exercises arranged according to learning objectives. However, the LKPD used in statistics learning is often still procedural, dominated by routine exercises, and less connected to students' daily lives and cultural environments. As a result, students tend to focus on completing formulas or procedures without fully understanding how statistical information can be represented and interpreted meaningfully (Safitri *et al*., 2022; Arief *et al*., 2024).

Ethnomathematics can be used as an approach to make mathematics learning more contextual because it connects mathematical concepts with cultural practices found in society. Recent studies have shown that ethnomathematics-based learning materials can support students' mathematical understanding, communication, reasoning, and representation skills by presenting mathematical concepts through familiar cultural contexts (Astuti *et al*., 2022; Ramadhana *et al*., 2024; Wulansari *et al*., 2025). Therefore, integrating local culture into LKPD can be an alternative for designing mathematics learning materials that are closer to students' real experiences.

Nevertheless, previous ethnomathematics studies have mostly focused on geometry, patterns, measurement, transformation, and cultural artifacts, while the use of ethnomathematics in statistics learning remains limited (Deda *et al*., 2024; Fauzan *et al*., 2025; Irvandi & Darma, 2024; Nursyahidah *et al*., 2025). In the context of *Seren Taun*, this tradition has been recognized as a cultural practice that contains various quantitative activities, such as counting, measuring, classifying, comparing quantities, and organizing harvest-related information. However, *Seren Taun* has not been specifically developed as a contextual mathematics learning material, particularly in the form of statistics worksheets designed to facilitate students' mathematical representation skills. This condition shows a research gap in the validation of *Seren Taun* ethnomathematics-based statistics worksheets as a culturally responsive learning material.

The *Seren Taun* tradition, as a Sundanese agrarian thanksgiving ritual, contains cultural activities that can be connected to statistics learning (Amalia & Haryana, 2022; Ferescky *et al*., 2024). These activities include counting, classifying, comparing quantities, measuring harvest yields, organizing information, and interpreting food distribution in the community. Such cultural practices are relevant to descriptive statistics concepts, such as data collection, data classification, data presentation, and data interpretation. Therefore, *Seren Taun* can be used as a meaningful cultural context in developing statistics worksheets that guide students to represent statistical information visually, symbolically, and verbally.

Based on these considerations, it is necessary to develop and validate statistics worksheets based on *Seren Taun* ethnomathematics. The validation process is important to

ensure that the worksheets are appropriate in terms of content, presentation, language, visual design, and their alignment with indicators of mathematical representation skills. Thus, this study aims to determine the validity of *Seren Taun* ethnomathematics-based statistics worksheets to facilitate students' mathematical representation skills. The product validation is conducted through expert judgment so that the resulting worksheets can be considered feasible for further testing or classroom implementation.

2. METHOD

Research Design

This study employed research and development (R&D) using the ADDIE development model. The ADDIE model consists of five systematic stages, namely analysis, design, development, implementation, and evaluation, and is commonly used in instructional design and learning product development because each stage provides a structured procedure for identifying learning needs, designing instructional materials, developing products, implementing them, and evaluating their quality (Shakeel *et al*., 2023; Rusdi *et al*., 2022). The product developed in this study was a statistics worksheet based on *Seren Taun* ethnomathematics designed to facilitate students' mathematical representation skills. In line with the focus of this article, the study was limited to product validation and did not examine the effectiveness of the worksheet in classroom learning.

The stages reported in this article included analysis, design, and development. The implementation and evaluation stages were not reported because this article focused only on producing the worksheet prototype, conducting expert validation, and revising the product based on validators' comments and suggestions. Therefore, the study did not yet examine the practicality or effectiveness of the worksheet in classroom learning. The implementation and evaluation stages are recommended for further research after the product has been declared valid by experts. The analysis stage was conducted through literature study and interviews. The literature study was used to identify *Seren Taun* cultural activities relevant to statistics learning, while interviews with the mathematics teacher and students were used to identify learning problems, students' characteristics, and students' needs in statistics learning. The design stage was conducted by preparing the worksheet structure, learning activities, *Seren Taun* cultural contexts, statistical problems, and expert validation instruments. The development stage was conducted by producing the worksheet prototype, validating it through expert judgment, and revising the product based on validators' comments and suggestions.

Research Subject and Location

This research was conducted at SMAN 3 Cikarang Utara as the location for collecting preliminary data. The preliminary data sources consisted of one mathematics teacher and three grade XI students. The teacher was involved to provide information about statistics learning, students' difficulties in mathematical representation, learning materials used in class, and the need for contextual worksheets. The students were involved to provide information about their learning difficulties, learning interests, and familiarity with the *Seren Taun* tradition. The preliminary data were used as the basis for identifying learning needs and designing the worksheet prototype.

The validation subjects consisted of six expert validators, namely two material experts, two cultural experts, and two media experts. The material experts assessed the suitability of the worksheet content, statistical concepts, presentation, language, and alignment with mathematical representation indicators. The cultural experts assessed the

accuracy and relevance of the *Seren Taun* cultural context integrated into the worksheet. The media experts assessed the visual design, layout, typography, readability, and graphical feasibility of the worksheet.

Research Instruments

The instruments used in this study were questionnaires, interview guidelines, and literature study guidelines. The questionnaire was used to collect quantitative validation data from expert validators. The validation questionnaire was arranged based on the aspects assessed by each expert. The material expert questionnaire covered content feasibility, presentation feasibility, language feasibility, and the suitability of worksheet activities with mathematical representation indicators. The cultural expert questionnaire covered the accuracy of *Seren Taun* cultural information and the relevance of cultural activities to statistics learning. The media expert questionnaire covered layout, typography, visual design, readability, and graphical feasibility.

The interview guidelines were used to collect preliminary qualitative data from the mathematics teacher and students. The interview with the teacher focused on problems in statistics learning, students' difficulties in mathematical representation, learning materials used in class, and the need for contextual worksheets. The interview with students focused on their learning difficulties, learning interests, and familiarity with the *Seren Taun* tradition.

The literature study guidelines were used to collect and organize information about *Seren Taun* cultural activities. The information was obtained from books, journal articles, previous research reports, and cultural documentation. The results of the literature study were used to identify *Seren Taun* activities related to statistics concepts, such as counting, measuring, classifying, comparing quantities, organizing data, and interpreting harvest distribution.

Data Collection Technique

Data were collected through literature study, interviews, and questionnaires. Literature study was conducted to obtain secondary data related to the *Seren Taun* tradition and its mathematical potential. Interviews were conducted with the mathematics teacher and students to identify learning needs and problems in statistics learning. Questionnaires were distributed to expert validators to assess the validity of the developed worksheet002E

Data Analysis Technique

The data analysis technique used in this study was descriptive percentage analysis. The data obtained from the expert validation questionnaires were analyzed to determine the validity level of the *Seren Taun* ethnomathematics-based statistics worksheet. The validation questionnaire used a four-point Likert scale. Each item was scored based on the validators' responses, as presented in Table 1.

Table 1. Scoring Criteria of The Expert Validation

Response Category	Score
Strongly Agree	4
Agree	3
Disagree	2
Strongly Disagree	1

The score for each statement item was calculated by adding the scores given by all validators. The total score obtained was then divided by the maximum possible score and

multiplied by 100%. The validity percentage for each item was calculated using the following formula:

$$V_i = \frac{S_i}{S_{max}} x100\% \quad (1)$$

where V_i is the validity percentage of each item, S_i is the total score obtained for each item, and S_{max} is the maximum possible score for each item.

After the validity percentage of each item was obtained, the overall validity score was calculated by adding all item validity percentages and dividing them by the number of statement items. The overall validity score was calculated using the following formula:

$$V = \frac{\Sigma V_i}{n} \quad (2)$$

Where V is the overall validity percentage, ΣV_i is the total percentage score of all items, and n is the number of statement items. The final validity percentage was then interpreted based on the validity criteria adapted from product validation criteria used in educational development research, as presented in Table 2 (Akbar, 2013; Kari *et al*., 2022).

Table 2. Validity Level

Percentage	Validity Level
1 – 50%	Invalid
50.1 – 70%	Less Valid
70.1 – 85%	Quite Valid
85.1 – 100%	Very Valid

The worksheet was considered feasible if the final validity percentage reached at least the quite valid category. Qualitative comments and suggestions from validators were used as the basis for revising the worksheet.

3. RESULTS AND DISCUSSION

3.1. Results

This study produced a final product in the form of a statistics worksheet based on *Seren Taun* ethnomathematics for grade XI senior high school students. The worksheet was designed to facilitate students' mathematical representation skills through visual, symbolic, and verbal activities integrated into statistics learning.

The cover of the worksheet is presented in Figure 1. The cover contains the title of the worksheet, the grade level, student identity columns, and visual documentation related to the *Seren Taun* tradition. The use of cultural images on the cover introduces students to the local cultural context from the beginning and emphasizes that the worksheet is designed as a culturally responsive learning material.

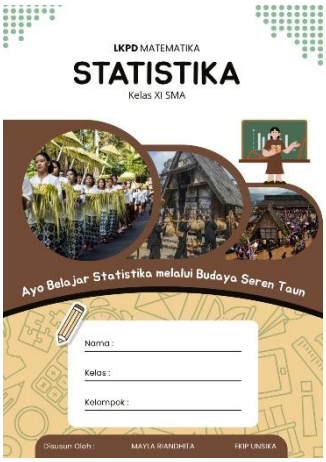

Figure 1. Cover of the *Seren Taun* ethnomathematics-based statistics worksheet

The introductory page of the worksheet is presented in Figure 2. This section introduces the *Seren Taun* tradition as a Sundanese cultural heritage and connects it with statistical activities. The worksheet explains that *Seren Taun* contains observable and countable activities, such as the number of harvested products, the number of participants, and the duration of traditional events. These activities are then linked to the basic concept of statistics, namely collecting, organizing, presenting, analyzing, and interpreting data.

Figure 2. Introductory section integrating *Seren Taun* and statistics

Figure 2 also shows the beginning of Kegiatan 1.1, which guides students to observe data related to the *ngajayak* procession. In this activity, students are introduced to data on the number of rice bundles carried during the procession. This section is designed to stimulate students' visual, symbolic, and verbal representations because students are required to observe cultural phenomena, read numerical data, and explain the meaning of the data in a statistical context.

The worksheet activity for constructing a grouped frequency table is presented in Figure 3. This section guides students step by step to determine the range, the number of classes using Sturges' rule, the class interval length, the class boundaries, and the grouped frequency table. These activities show that the worksheet does not only provide final exercises, but also scaffolds students in organizing data systematically. Through this activity,

students are trained to develop symbolic representation through formulas and statistical procedures, as well as visual representation through tables.

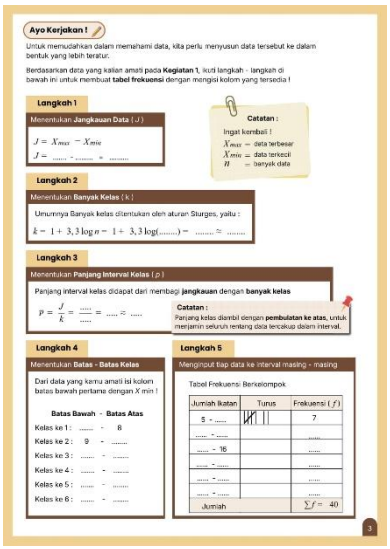

Figure 3. Worksheet activity for constructing a grouped frequency distribution table

The discussion section designed to facilitate verbal representation is presented in Figure 4. In this section, students are asked to identify several types of graphs, interpret histograms, and explain information from an ogive. These tasks encourage students to communicate statistical information in written form. Therefore, this part of the worksheet directly supports students' verbal representation skills because students are required to explain data trends, compare information, and draw conclusions based on statistical representations.

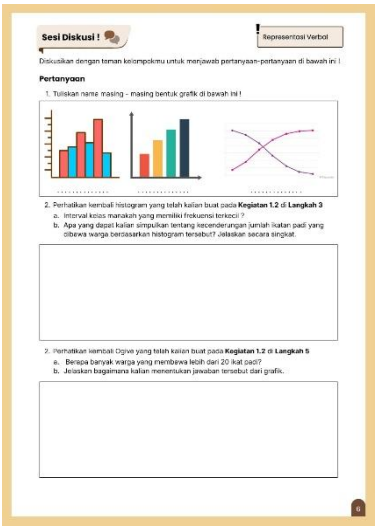

Figure 4. Discussion section for facilitating verbal representation

The practice section of the worksheet is presented in Figure 5. This section contains contextual problems related to the *Damar Sewu* procession in the *Seren Taun* tradition. Students are asked to determine the mean, median, and mode of participants' ages based on a histogram and explain how the results can be used by the committee to plan the next *Seren Taun* event. This task connects statistical computation with contextual interpretation. Thus,

students are not only required to calculate statistical values, but also to interpret the meaning of the results in relation to the cultural event.


SOAL LATIHAN

Gambar 3. Damar Sewu

Pada tradisi *Seren Taun* yang dilaksanakan setiap tahun, salah satu rangkaian pembuka acara adalah Damar Sewu, yaitu prosesi menyalakan obor pada malam hari sebagai simbol penerang kehidupan dan bentuk penghormatan kepada leluhur. Prosesi ini biasanya dilaksanakan menjelang puncak acara *Seren Taun* pada tanggal *22 Reyegung*. Di Cigugur, prosesi *Damar Sewu* dilaksanakan di sekitar Gedung Paseban Tri Panca Tunggal. Suasana pelaksanaan prosesi tersebut dapat dilihat pada Gambar 3.

Dalam kegiatan tersebut, para pemuda bertugas untuk merealisasikan *Damar Sewu* dengan cara menyalakan dan menyebarkan obor ke berbagai titik di sekitar area upacara, seperti jalan, halaman, dan lingkungan sekitar Paseban. Seorang panitia adat kemudian mencatat jumlah obor (*damar*) yang dipasang di beberapa titik lokasi berbeda untuk mengetahui bagaimana persebaran *damar* pada kegiatan tersebut sebagai berikut :

Damar (X)	14	15	16	18	20	21	22	23	24	25	40
Banyaknya Titik lokasi (f)	1	1	1	2	5	6	9	7	6	6	1

Tugas!

1. Sajikan data tersebut ke dalam tabel distribusi frekuensi berkelompok !
2. Berdasarkan tabel yang telah kallan buat, sajikan data tersebut dalam bentuk Histogram !
3. Berdasarkan Histogram yang kallan sajikan, menurut kallan bagaimana persebaran jumlah *damar* pada berbagai lokasi tersebut ?

Figure 5. Practice problem based on the *Seren Taun* tradition

In addition to the practice section, the worksheet also includes a reflection session that guides students to review the learning process. In this section, students are asked to write what they have learned, identify the parts they still find difficult, and explain how they can overcome these difficulties. This reflection activity supports verbal representation because students are encouraged to communicate their understanding, learning obstacles, and interpretation of statistical concepts in written form.

Overall, the final product shows that the developed worksheet integrates three important components: statistics content, *Seren Taun* cultural context, and mathematical representation skills. The worksheet facilitates visual representation through images, tables, histograms, and ogives; symbolic representation through formulas and statistical procedures; and verbal representation through explanation, interpretation, and conclusion tasks.

The validity of the developed worksheet was assessed by two validators in each expert category, namely material experts, cultural experts, and media experts. The validation results show that the worksheet obtained a score of 96% from material experts, 86% from cultural experts, and 97% from media experts. Based on the validity criteria used in this study, all three validation results were categorized as very valid. The average validity score across all expert categories was 93%, which indicates that the worksheet was very valid and feasible to use as a statistics learning material that is present in table 3. The detailed validation results for each assessment aspect are presented in Tables 4–6.

Table 3. Summary of Worksheet Validation Results

Expert Category	Validity Percentage	Category
Material Expert	96%	Very Valid
Cultural Expert	86%	VeryValid
Media Expert	97%	Very Valid
Average	**93%**	**Very Valid**

Table 4. Material Expert Validation Results

Assesment Aspect	Validity Percentage	Category
Content feasibility	92%	Very Valid
Presentation feasibility	100%	VeryValid
Language feasibility	97%	Very Valid
Suitability with mathematical representation indicators	96%	Very Valid
Average	**96%**	**Very Valid**

Table 5. Cultural Expert Validation Results

Assesment Aspect	Validity Percentage	Category
Relevance of culture to the material concepts	88%	Very Valid
Accuracy of cultural information	85%	Quite Valid
Average	**86%**	**Very Valid**

Table 6. Media Expert Validation Results

Assesment Aspect	Validity Percentage	Category
Physical size	100%	Very Valid
Cover design	98%	Very Valid
Content design	96%	Very Valid
Average	**97%**	**Very Valid**

3.2. Discussion

The overall validation result of 93% indicates that the *Seren Taun* ethnomathematics-based statistics worksheet met the validity criteria from the material, cultural, and media aspects. The material experts gave a score of 96%, the cultural experts gave 86%, and the media experts gave 97%, all of which were categorized as very valid. These results show that the worksheet is feasible as a contextual learning material for statistics, particularly because the validation involved different areas of expertise. In learning product development, expert validation is important to ensure that the product is appropriate in terms of content, cultural relevance, presentation, readability, and instructional design before being used in a wider learning setting (Laksana, 2024; Mertasari & Candiasa, 2022; Nayazik, 2024; Sari *et al*., 2025).

The 96% material validation score shows that the statistical content, learning sequence, language, and representation-based activities were considered highly appropriate. The worksheet guides students to construct grouped frequency tables, interpret histograms and ogives, and calculate measures of central tendency through the context of *Seren Taun*. These activities indicate that the worksheet does not merely provide exercises, but also supports students in organizing data, applying statistical procedures, and explaining the meaning of data in context. This is consistent with the function of LKPD as a structured learning guide that helps students explore concepts, organize mathematical ideas, and complete learning activities independently (Nabilla *et al*., 2022; Teresa *et al*., 2022). The

material validation also confirms that the worksheet is aligned with mathematical representation skills because it facilitates visual representation through tables and graphs, symbolic representation through formulas and procedures, and verbal representation through written explanations and interpretations (Fitriya & Permatasari, 2022; Novitasari *et al*., 2021; Ritmayanti *et al*., 2025).

The 86% cultural validation score indicates that the *Seren Taun* context was considered relevant and appropriate to be integrated into statistics learning. In the worksheet, *Seren Taun* is not presented only as cultural information, but also as a source of statistical activities, such as counting rice bundles, classifying harvest data, comparing quantities, organizing information, and interpreting community participation in the *ngajayak* procession. This integration reflects the principle of ethnomathematics, which connects formal mathematical concepts with cultural practices found in society and supports culturally meaningful mathematics learning (Fouze & Amit, 2018; Rosa & Orey, 2016; Wulansari *et al*., 2025). The result also strengthens the argument that local culture can serve as a meaningful context for developing learning materials, especially when cultural practices are transformed into mathematical activities that students can observe, analyze, and represent (Astuti *et al*., 2022; Aulia, 2025; Ramadhana *et al*., 2024; Rahayu *et al*., 2025).

The 97% media validation score shows that the worksheet was considered very valid in terms of visual design, layout, typography, readability, and graphical presentation. As shown in Figures 1 to 5, the worksheet uses contextual images, clear activity labels, consistent color composition, structured answer spaces, and readable typography. These elements help students follow the learning flow and understand the tasks more easily. The quality of visual and layout design is important because learning materials should not only be accurate in content, but also clear, readable, and visually supportive of students' learning processes (Rahmi, 2023; Laksana, 2024). Therefore, the high media validation score indicates that the worksheet design supports the instructional purpose of the product.

The validators' suggestions were used to improve the worksheet before it was finalized. The first suggestion was to write mathematical symbols using proper equation format, while the second was to revise the procedure for determining quartiles in single data. An example of the revision related to the quartile procedure is presented in Figure 6. The revision strengthened the accuracy of symbolic notation and the correctness of statistical procedures. This shows that expert validation in this study did not only function to produce a validity score, but also served as a formative evaluation process to refine the product based on expert feedback (Mertasari & Candiasa, 2022; Laksana, 2024).

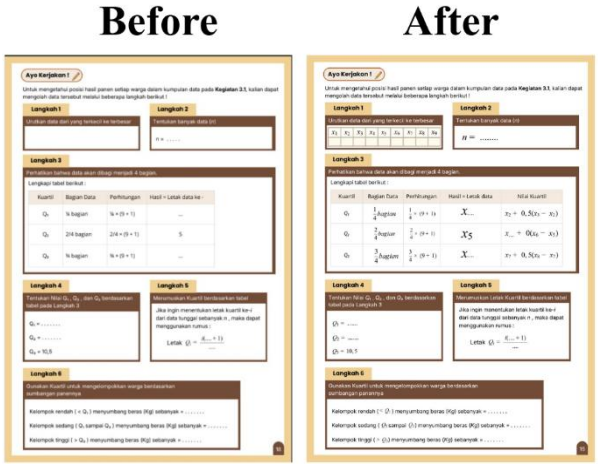

Figure 6. The worksheet display before and after revision of the quartile procedure

Based on these findings, the *Seren Taun* ethnomathematics-based statistics worksheet can be categorized as very valid. The worksheet is feasible to be used as a contextual learning material to facilitate students' mathematical representation skills in statistics learning. However, because this article focuses only on product validation, further research is needed to examine the practicality and effectiveness of the worksheet in classroom implementation.

Practically, the Seren Taun ethnomathematics-based statistics worksheet can serve as an alternative contextual teaching material for mathematics teachers. The worksheet helps teachers integrate local cultural values into statistics learning while guiding students to represent data visually, symbolically, and verbally. For schools, this product can support culturally responsive mathematics learning by connecting statistical concepts with local wisdom found in students' social and cultural environment. Thus, the worksheet is not only useful as a learning material, but also as an effort to preserve local culture through mathematics education.

4. CONCLUSION

The study shows that the *Seren Taun* ethnomathematics-based statistics worksheet is valid and feasible to be used as a contextual learning material for grade XI students. The worksheet was developed by integrating statistical concepts with *Seren Taun* cultural activities, such as counting, classifying, organizing, presenting, and interpreting data. The validation results from material experts, cultural experts, and media experts showed that the worksheet met the very valid category. This indicates that the worksheet is appropriate in terms of statistical content, cultural relevance, presentation, language, visual design, and its alignment with mathematical representation indicators. Therefore, the developed worksheet can be used to facilitate students' mathematical representation skills through visual, symbolic, and verbal activities in statistics learning.

Since this study was limited to product validation, further research is suggested to examine the practicality and effectiveness of the worksheet in classroom implementation. Future studies may involve teachers and students in a limited trial to investigate how the worksheet supports learning activities, students' engagement, and mathematical representation skills in actual statistics learning. In addition, further development can expand the *Seren Taun* context into other statistical topics or compare it with other local cultural contexts to enrich ethnomathematics-based mathematics learning materials.

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