

Mathematical braiding in the production of leather purses

Kevin Manuel Pérez Jiménez^a 
 Sebastian Yesid Villegas Olivero^a 
 Armando Alex Aroca Araujo^b 

^a Universidad del Atlántico, Programa de Pregrado en Educación Matemática, Puerto Colombia, Colombia.

^b Universidad del Atlántico, Licenciatura en Matemáticas, Puerto Colombia, Colombia.

ABSTRACT

Background: The research problem consisted of understanding the mathematics used in the process of making leather purses. **Objective:** The primary objective was to identify the mathematical concepts used in making leather purses, focusing on the relationships between measurements, cutting, joining pieces, and distributing materials. **Design:** The research is theoretically grounded in the ethnomathematics program and related research. **Setting and participants:** This research was conducted in the municipality of Soledad, Atlántico Department, Colombia. One participant agreed to collaborate with this investigation. **Data collection and analysis:** The employed methodology was qualitative, utilising an ethnographic approach and information collection methods that included observation, semi-structured interviews, and audiovisual recording using electronic devices. **Results:** The results worth highlighting are the phases of leather cutting, die-cutting, stitching, and purse braiding, where mathematical processes, such as systems of units of measurement and equivalences, are evident. **Conclusions:** The discussion suggests that these results may have implications for the teaching of specific topics in mathematics education, such as units of length (decimeters, centimetres, and meters), basic operations (addition, subtraction, multiplication, and division), estimation of measurements, and equivalences.

Keywords: Ethnomathematics; Mathematics education; Crafts; Measurement systems; Leather.

Trenzados matemáticos con la elaboración de monederos de cuero

RESUMEN

Contexto: El problema de investigación consistió en la comprensión de las matemáticas empleadas en el proceso de elaboración de monederos de cuero. **Objetivo:** El objetivo principal fue identificar los conceptos matemáticos implementados en la elaboración de monederos de cuero, haciendo énfasis en las relaciones de correspondencia en cuanto a medición, corte, unión de piezas y distribución de

Corresponding author: Armando Alex Aroca Araújo.

Email: armandoaroca@mail.uniatlantico.edu.co

materiales. **Diseño:** La investigación está respaldada teóricamente por el Programa Etnomatemática e investigaciones de procesos de los temas afines. **Escenario y participantes:** Esta investigación se llevó a cabo en el municipio de Soledad, departamento del Atlántico. Se dispuso de 1 participante que accedió a colaborar con esta indagación. **Recopilación y análisis de datos:** La metodología empleada fue de tipo cualitativo, de enfoque etnográfico, con método de recolección de información por medio de observación y entrevista semiestructurada, con registro audiovisual por medio de dispositivos electrónicos. **Resultados:** Los resultados a destacar son las fases del corte del cuero, del troquelado del cuero, de la costura del cuero y del proceso del trenzado del monedero, donde se evidencian diferentes procesos matemáticos para su desarrollo como sistemas de unidades de medida y equivalencias. **Conclusiones:** La discusión plantea que estos resultados pueden tener conexiones para favorecer la enseñanza de algunos temas en educación matemática como unidades de longitud (decímetros, centímetros y metros), operaciones básicas (suma, resta, multiplicación y división), estimación de medidas, equivalencias, etc.

Palabras clave: Etnomatemática; Educación matemática; Artesanía; Sistema de Medidas; Cuero.

Trançados matemáticos com a confecção de bolsas de couro

RESUMO

Contexto: O problema de pesquisa consistiu em compreender a matemática utilizada no processo de confecção de bolsas de couro. **Objetivos:** O objetivo principal foi identificar os conceitos matemáticos implementados na produção de bolsas de couro, enfatizando as relações de correspondência em termos de medição, corte, junção de peças e distribuição de materiais. **Design:** A pesquisa está amparada teoricamente no Programa Etnomatemática e processa investigações dos temas para os fins. **Ambiente e participantes:** Esta pesquisa foi realizada no município de Soledad, departamento do Atlântico. Houve 1 participante que concordou em colaborar com esta investigação. **Coleta e análise de dados:** A metodologia utilizada foi qualitativa, com abordagem etnográfica, com método de coleta de informações por meio de observação e entrevistas semiestruturadas, com registro audiovisual por meio de dispositivos eletrônicos. **Resultados:** Os resultados a serem destacados são as fases de corte do couro, corte e vinco do couro, costura do couro e processo de trançado de bolsa, onde ficam evidentes diferentes processos matemáticos para o seu desenvolvimento, como sistemas de unidades de medida e equivalências. **Conclusões:** A discussão sugere que esses resultados podem ter conexões para favorecer o ensino de alguns tópicos da educação matemática, como unidades de comprimento (decímetros, centímetros e metros), operações básicas (adição, subtração, multiplicação e divisão), estimativa de medidas, equivalências, etc.

Palavras-chave: Etnomatemática; Educação matemática; Arte; sistema de medição; Couro.

INTRODUCTION

The leather purse

A leather purse is an accessory designed to hold cash, credit cards, and other small personal items. Its size is usually no larger than the palm of a hand. As its name suggests, it is made primarily from leather, a strong, malleable material derived from animal skin, specifically cowhide. Leather is not just the skin of an animal; it is a material crafted by a tanner, who transforms it into a flexible, aesthetically pleasing, and tactile resource suitable for multiple applications (Michael, 1993).

This research examines the various mathematical processes involved in the manufacture of leather purses, in collaboration with a craftsman from the municipality of Soledad, Atlántico Department, Colombia, who shared his knowledge and experiences.

Theoretical framework

To understand the mathematics involved in the artisanal production of leather purses, it is essential to have a theoretical foundation to support this research. In this context, Aroca-Araujo et al. (2024) tell us that the ethnomathematics program is a valuable support for this type of research, since research in ethnomathematics has studied the mathematical knowledge that people develop when they carry out their daily practices (Rodriguez-Nieto, 2021) as well as community mathematical knowings (Aroca, 2024)

Similarly, ethnomathematics also develops attitudinal and personal competencies that are essential for professional development, as they promote a collaborative and constructive environment. This idea is supported by D'Ambrosio (2021), who states that ethnomathematics is valued as a legitimate educational practice that promotes creativity, effort, cultural self-respect, and provides an inclusive vision of humanity, increasingly oriented towards multiculturalism and pluriculturalism.

D'Ambrosio (2021) affirms that in everyday life, ethnomathematics is increasingly recognised as a knowledge system that facilitates the creation of more positive and harmonious relationships, both in human behaviour and in the interaction between people and nature. This idea is particularly relevant in the artisanal manufacture of leather purses, as artisans apply mathematical processes while respecting traditional techniques that have evolved.

Rosa et al. (2017) propose that to understand the evolution of ethnomathematics as a project from its origin to its future projection, it is

essential to examine its present and future visions, which involve analysing goals, purposes, and expectations for ethics, respect, solidarity, and intercultural collaboration. In this sense, when making leather purses, the artisanal practice of leather requires a deep understanding of tradition and techniques, allowing for the sharing of knowledge from one generation to the next. Furthermore, this process fosters respect for techniques and intercultural exchange, enriching and keeping this practice alive, as ethnomathematics has emerged as an area of research that broadens the understanding of mathematical conceptualization by valuing and studying the mathematical practices of diverse cultures, without underestimating any of them (Umbara et al., 2021).

In the making of leather purses, when conducting an ethnomathematical research, one can see how artisans apply mathematical concepts in an intuitive and culturally contextualised manner. In other words, ethnomathematics investigates the mathematical knowledge and practices that individuals and various groups develop over time, evolving and adapting in response to their changing needs and behaviours (de Lima & de Souza, 2020).

Mathematical concepts

As we are also interested in developing a conceptualisation of what constitutes a measurement system, we understand one in operation and applied in a craft practice. We reflect on our understanding of a measurement system, analysing its contributions to mathematics education (Aroca et al., 2022). According to Romero Chacón and Rodríguez Rodríguez (2009), the measurement process is the simple application of a predefined instrument to the object or system in question, and the reading of the numerical value indicated on the instrument's scale. This numerical value is considered, therefore, as the result of the measurement and represents the value of the measured property. We can say, then, that the accuracy of the measurements in the elaboration of purses will be one of the essential processes, due to the diversity of instruments that the artisan uses for this purpose. Additionally, the use of these instruments helps avoid errors that could impact the quality and functionality of the final product.

At the same time, Bishop (1999) notes that measurement is a crucial activity for developing mathematical thinking, as it facilitates processes such as estimation, understanding magnitudes, using metric systems and units of measurement, and abstraction and quantification. In addition, it is one of the most valuable activities in all cultures, because it is used to compare, order, estimate, and calculate different magnitudes with precision.

Thus, measuring is crucial for developing various tasks, especially in creating purses, as it provides the precision and consistency necessary to achieve satisfactory results. There are other widely used measurements in activities such as masks, where artisans must accurately measure the dimensions to ensure that the final product fits properly and has a professional finish (Paternina-Borja et al., 2020). In artisanal fishing, correctly measuring gear is vital to maximise catch (Rodríguez-Nieto et al., 2019). In masonry, the use of measurements and estimates is crucial for building any structure (Rey-Muños & Aroca-Araújo, 2011). Likewise, in wood crafts, artisans must measure and cut accurately to create high-quality pieces (Aroca, 2016).

These activities often employ traditional measurement methods, such as the *jeme* (the distance between the index and the thumb fingertips), the *cuarta* (one palm), and the fathom, which are forms of measurement based on parts of the human body or everyday objects. These methods are not formally included in the International System of Units (SI), but remain widely used in many communities due to their accessibility and convenience. These measurement systems enable people to solve practical problems in their everyday lives by adapting measurement techniques to their specific needs and cultural contexts. These methods also represent valuable traditional knowledge that complements more formal and technical measurement systems.

From the above, it is evident that research focused on understanding other ways of measuring, highlighting the importance of mathematics in cultural practices and, especially, in the workplace (Rodríguez-Nieto et al., 2019). We note that precision is crucial at every stage of measurement and fitting in the production of leather purses to achieve a high-quality final product. This focus on detail and proper tooling ensures that the purse is both functional and visually appealing. We must note that artisans employ a form of contextualised mathematics, utilising their own measurement methods, which enables them to make the necessary equivalencies and adjustments to meet the daily challenges of their work and satisfy the specific demands of their craft.

METHODOLOGY

The essential characteristics of the methodology used in this research are detailed below.

Type of research

The methodology employed in this research was characterised by a qualitative approach, which, according to Córdoba (2017), involves exploring experiences and beliefs. The researcher, therefore, seeks to gain a profound and

natural understanding of the phenomenon within that specific context. The nature of this research is ethnographic, characterised by the subphases proposed by Aroca (2022), as illustrated in Figure 1.

Figure 1

Ethnographic phase. Adapted from: Aroca (2022).



Context and participant

In this first subphase, we will focus solely on understanding the mathematical connections and learning about the craft. The first step was to select a specific sample of the population working in this artisanal sector, thereby identifying the mathematical concepts used in their practice. This phase was complex because many artisans are reluctant to share their culture, which characterises this investigation as ethnographic. Among the current research population, one participant agreed to collaborate with this investigation: artisan Lenin, a 63-year-old individual with approximately 30 years of experience in making leather purses, currently residing in the municipality of Soledad, Atlántico.

The location

Balcázar et al. (2013) state that, to access private environments, such as homes, and personal situations, it is essential to locate both the settings and the people involved. Additionally, each participant must give their consent. Our research activity began with the recognition of the practice site: a workshop in the Villa Zambrano neighbourhood of the municipality of Soledad, Atlántico. It was also the place where we established contact with our future collaborator, craftsman Lenin. This contact not only played a crucial role in establishing a relationship of trust between us and the practice site, but also helped ensure our safety throughout the activity.

Strategies and methods of information collection

In this subphase, we designed a semi-structured interview protocol. The categories obtained are as follows: *Getting to Know the Artisan, Balance, Step by Step, Motivation and Passion, Acquisition of Materials, Maintenance, Utensils, Design, Quality, and Sales*. We also used participant observation, which, according to Piñeiro (2015), is a technique for collecting, analysing, and interpreting information where the researcher is actively involved in the interactions within the group being studied. By observing what people do and how they do it, we seek to understand the reasons behind their actions.

Electronic devices, microphones, and field notes were used to collect fieldwork information, along with the transcripts.

Immersion

This data collection subphase was divided into two field studies. The first included a semi-structured interview with the artisan, facilitating an exploration of the respondents' beliefs and opinions, as well as their personal context, which directly influences their discourse (Ibarra-Sáiz et al., 2023). Likewise, we asked questions that had been previously categorised within an interview protocol to cover the possible processes involved in making leather purses and other categories, in order to get to know the artisan. Firstly, one of the main categories of the interview was '*Getting to Know the Artisan*', which allowed us to understand the social context of the interviewee, as well as personal information such as age and experience in practice. Secondly, we have the category '*Step by step*', which was fundamental in the interview, as its purpose was to understand the artisan's process for making leather purses. Finally, we have the category '*Utensils*', which not only enabled us to learn about the instruments used by the artisan but also the techniques associated with said employment. During the semi-structured interview, we maintained a

flexible approach. As Folgueiras (2016) states, the interviewer must be open to adapting and changing the question according to the answers that arise. It may even be necessary to incorporate new questions based on the respondent's answers.

The second fieldwork project was conducted to understand and analyse the mathematical concepts involved in the processes of making leather purses.

Audiovisual productions

Thanks to the data collection methods, we were able to create six audiovisual productions. Of these, three are the result of semi-structured interviews, and two focus on the production process. In one of these videos, we delve specifically into the braiding process to gain a better understanding. Finally, we have a methodological video that explains the process, supported by images related to the topic.

We shared all the results of the audiovisual productions with Artisan Lenin to promote his craft practice for his own benefit.

RESULTS AND ANALYSIS

For our study, we observed the participant, artisan Lenin, make leather purses. To achieve the expected result, he went through an extensive series of stages, which included cutting, die-cutting, painting the leather, cutting and glueing the slide, sewing, perforating, making strips, and braiding the purse (the leather, paint, slide, glue, and ribbons were purchased at the Barranquilla city market). The stages and the observed mathematical processes will be described below. We used the abbreviations (I) for the interviewer/researcher and (P) for the participant in the interview fragments.

Leather cutting

Before the leather-cutting process, the artisan purchases the materials at the city market, selecting the style and quantity, and then transports them to his home.

In the following interview fragment (Matemáticas del Pueblo [People's math], 2024), artisan Lenin tells us about the price of leather and how he buys the quantity he needs to work.

I: And, and what is the price of.../ this leather?

P: Well, I buy the leather by the decimeter; they sell it by the decimeter. I'm buying it right now; I'm buying it at seven hundred pesos per decimeter.

I: The decimeter.

P: Yes.

I: And how do you know how much leather to buy?

P: Well, / uh, a purse takes two point five decimeters.

I: Uh-huh.

P: Each purse, so I want to make a hundred purses, I know they are..., I must buy two hundred // two hundred and fifty decimeters, for 100 purses.

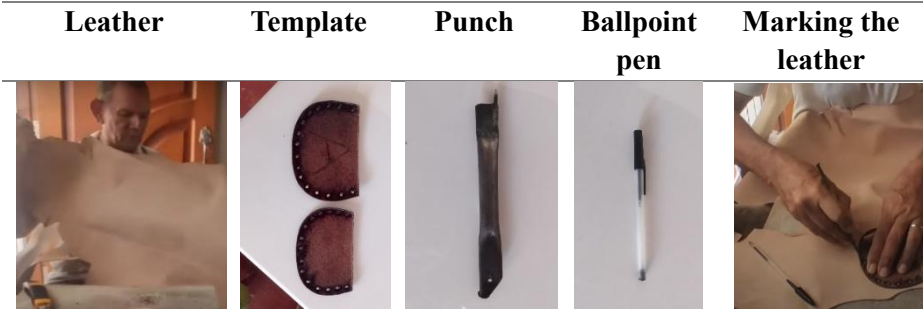
I: This you must / you have it already processed in your mind, or you calculate / to be able to know, to do the math.

P: I already have that (()) in my mind, of course at the beginning yes / my calculation was that // I bought a small amount of leather/ and, and, and I presented the molds / and there I (()) them, well from so many decimeters there are so many purses, and then, I made the calculation, that it gives, of, of the decimeters that each purse can hold / and from there the measurement came, and that is the measurement.

After purchasing the leather, we proceed to mark it completely, properly distributing the pieces of the purses. For this task, the artisan uses a previously made template, a self-made punch, and a pen. The template includes perforation points and the suitable size for each piece of leather. The awl, made from a small tube and a nail, is used to outline the pieces on the leather, while the pen is used to mark the piercing points of the pieces, as shown in Figure 2. The purpose of the template is to ensure that all the pieces of the purses are the same size.

Figure 2

Leather marking.



After marking all the leather, the artisan cuts along the outlines on each face. In this step, he uses a *cutter* (blade). See Figure 3.

I: And / what do you use this for?

P: This is an exact one for cutting leather.

Figure 3

Leather cutting



With the above information, the first ethnomathematical connections of the ethnographic phase were established (which are conducted by the researchers), such as relationships between the unit of measurement, equivalences, number of purses, and the price of leather expressed in pesos, as shown in Table 1.

Table 1

Equivalences between non-conventional units of measurement, length, and the price of leather.

Unit of measurement	Equivalence	Length	Price
1 face	$\frac{1}{2}$ coin purse	1.25 decimeters	\$ 875
1 purse	2 faces	2.5 decimeters	\$ 1,750
100 purses	200 faces	250 decimeters	\$ 175.000

To buy the *salpa* (regenerated leather or *cuerson*), he takes into account:

$$\begin{aligned}1 \text{ salpa} &= 100 \text{ cm wide} * 150 \text{ cm long} \\1 \text{ salpa} &= 1000 \text{ mm wide} * 150 \text{ cm long} \\1 \text{ strip} &= 5 \text{ mm wide} * 150 \text{ cm long} \\100 \text{ purses} &= 100 \text{ strips} \\200 \text{ strips} &= 1 \text{ salpa}\end{aligned}$$

Leather die-cutting

In this sub-phase, before starting to die-cut the leather, Mr. Lenin first separates all the leather faces into two equal stacks (quantity); that is, if he is going to make 100 purses, he divides the purses into two stacks of 100 faces each to place the two stamps each purse takes and ensure that they are distributed evenly, as the leather does not maintain a uniform thickness. After separating the leather, he takes small amounts of faces from each stack, moistens them with a sponge and water, and ensures the leather is soft for die-cutting. See Figure 4.

I: And / How does that work?

P: One is from the piece of / leather; one of the, of the two pieces that the leather has, (()) one takes this leather and wets it / it / it / to soften it so that the stamp // if you want, I can demonstrate it to you right away.

Figure 4
Separating and moisturising the leather.



After moisturising a part of the leather faces, Lenin proceeds to die-cut the faces of the purse, using the tools shown in Figure 5.

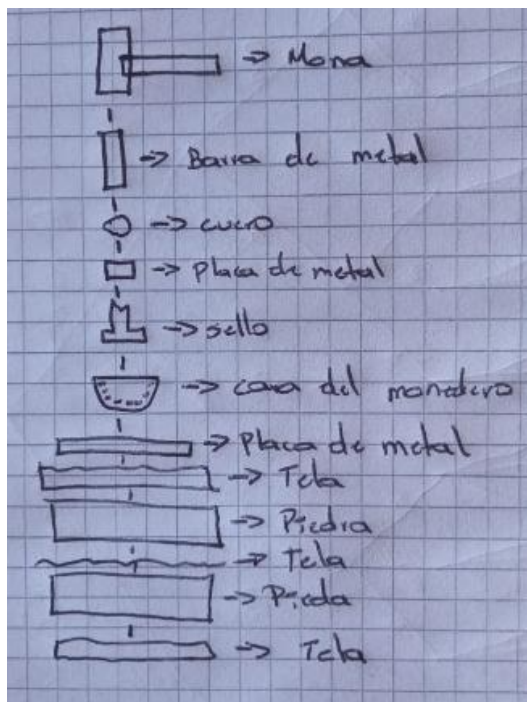
Figure 5.
Tools for punching leather.



Figure 6 shows Lenin’s drawings of each tool he uses.

Figure 6

Position of each of the tools used to punch out the leather (Lenin's drawing).



At this stage, Lenin hits (depending on the thickness of the leather) a metal bar with a hammer, which presses the seal into the previously moistened leather, transferring the image and/or word of the stamp. The other tools serve as a base, cushioning the impact and noise. Below is an excerpt from the interview to illustrate the information about noise damping.

I: And / if I'm not mistaken, I put // that, that little piece of leather there. What is that little piece of leather for?

P: This piece is to cushion the, what's it called?, the, the, the, the protection, the hammer, because if you // if I come and I place (()) it slips and the engraving doesn't, it doesn't come out well /// then, to sit the blow, you put the piece of leather on top // and it's to sit the blow // (()) like this without / the two irons just like this, iron with iron that slips, it immediately slips, then the normal engraving doesn't come out. I know that by experience (laughing).

After punching the leather, Lenin lets it dry for ten minutes. It must be dry so it can fully absorb the paint and not cause any problems. The following interview excerpt provides evidence to support the above information.

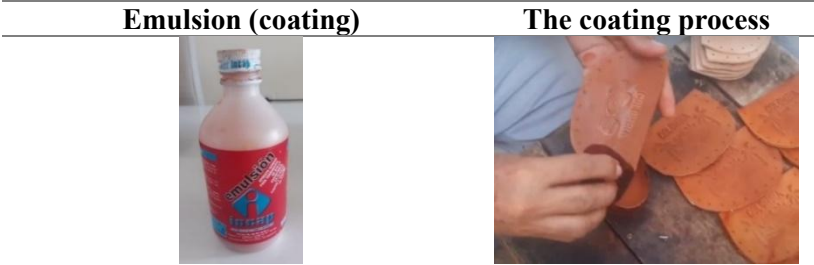
P: Here, // now you put this iron (()) out to dry so that the, the paint takes, you put it in the sun // for about ten minutes in the sun so that the water dries // so that you can then paint, so that the paint takes // because with water, the paint doesn't take well.

Leather painting

At this stage, Lenin coats all the sides of the purse with a special emulsion (paint), which gives it colour and style. In this process, he uses a sponge and a small container filled with the emulsion, making gentle side-to-side movements until the entire top of the purse is covered. The purpose of the smooth movements is to prevent air bubbles on the face of the leather. See Figure 7.

Figure 7

The painting process of the faces on the purse.



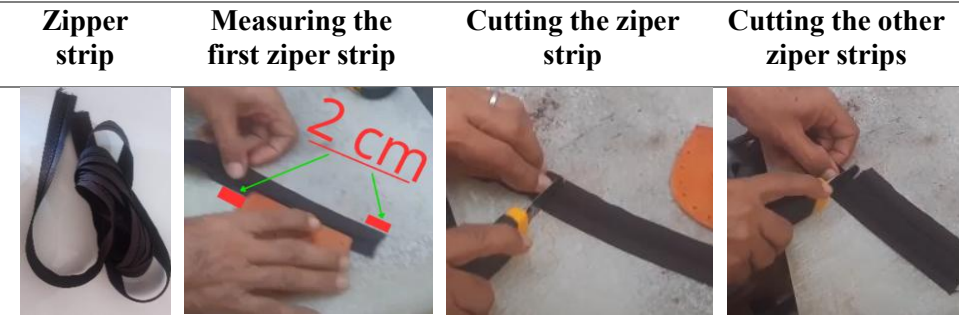
Cutting the slider

After completing the previous phase, Lenin proceeds to cut the zipper strips. He says that for every 100 purses, he buys 17 meters of zipper strips.

Subsequently, he cuts the zipper strips for each purse. Lenin uses the top of one side of the purse as a reference to cut the zipper with an *exacto* (cutter). In this step, Lenin places the top face of the purse over the zipper strip, ensuring that an extra 2 cm is left on each side of the purse; then, he cuts with the exact measurement taken. After cutting a piece, he uses it as a reference to count all the zipper strips he needs for the order. Figure 8 shows the process of cutting the zipper strips.

Figure 8

Zipper-strip cutting process.



Applying the glue

At this stage, Lenin applies a *uña de boxer*, where “uña” means measure *and* “boxer” refers to glue, to the faces of the purses and to the strips previously cut using the right index finger. On the face of the purses, he applies glue to the top back of the purse face and to both sides of the strips, ensuring the 2 cm added when cutting the zipper strips is visible. See Figure 9.

Figure 9

Process of applying glue to the leather and the zipper strips.



After applying the glue, he waits for at least two minutes for it to dry to ensure a good bond between the face of the purse and the zipper strip.

Glueing the leather to the zipper strips

In this phase, Lenin proceeds to adhere the zipper strip to the leather, joining and pressing both materials in the area where he applied the glue. This process involves working with two pieces of leather and a strip of leather.

However, to improve the appearance of the purse, he uses two different pieces of leather, as shown in Figure 10.

Figure 10

Process of joining the leather faces with the zipper.

Joining one leather face to the zipper strip	Joining the second face of the leather	Final product
		

Integrating the slider (tape, stops, pull tab) into the chain

At this stage of the process, Lenin inserts the slider into the teeth and then sews the tape to the leather. To insert the slider, Lenin separates one side of the excess tape for its integration, after which he places the slider from the top edge and slides it gently into the teeth, ensuring it remains in the centre of the zipper to facilitate the sewing process. See Figure 11 to corroborate this information.

Figure 11

Process for inserting the slider into the zipper teeth.

Separating the excess zipper	Inserting the slider	Results
		

Sewing the purse

After integrating the slider into the purse’s zipper, Lenin begins the sewing process. He uses an old Singer sewing machine and follows these steps: first, he detaches one of the excess ends of the zipper, ensuring it is the one at the front of the slider, as the other end will serve as the bottom stop. Next, he brings one end of the separated zipper to the side of the purse to begin sewing. The stitching begins at the side where the zipper is folded and extends to the end of the upper part of the purse. When he reaches the end, he sews the other side of the purse, repeating the process in the opposite direction (See Figure 12). That is, he starts from the end of the purse and ends at the fold at the other end of the tapes that were separated at the beginning.

Figure 12

Sewing process of the purse.

Sewing machine	End separation	Start of sewing
		
Sewing	Change of face	Final product
		

Purse hole punching

At this stage, Mr Lenin takes the already sewn purses and begins the punching process. To do this, he uses a #6 hole punch (punch or awl), a rubber mallet, a stone base, folds of fabric to cushion the blows, and an acrylic board to preserve the edge of the punch. First, he places a piece of fabric on the floor, followed by the stones, more fabric on top, and finally the acrylic board. He places the purse on the acrylic board. After that, he hits the punch with the rubber mallet, making sure to position the punch over the perforation points previously marked on the faces of the purse during the leather cutting process. See Fig.13.

Figure 13

Purse punching process.

Tools	Drilling	Results
		

Making strips for braiding

For this step, Lenin first spreads on the floor a fold of processed leather, known as *salpa* (regenerated leather or *cuerson*), 150 cm long by 100 cm wide, which will be used to make the strips with which the purses will be braided. This step is done to paint the entire fold evenly, using the same paint and sponge that he uses for the faces of the purse. Once the *salpa* has dried, Lenin uses a tool he created himself (without a specific name, see Figure 14), which consists of a piece of wood with a small slot in the centre through which the *salpa* passes. In this slot, a cutter blade is embedded, allowing the *salpa* strips to be cut. These strips are approximately 150 cm long and 5 mm wide. To carry out this process, first he makes minor cuts with scissors on the shorter edge of the *salpa*, which serve as a guide to extract the strips. Next, he inserts the tool into one of the cuts made on the edge of the *salpa* and slides it along the fold, thus obtaining a strip that will be used for braiding, as shown in Figure 14. This

procedure is repeated as many times as necessary to match the number of purses being made.

With the information provided by the craftsman, we concluded that:

$$\begin{aligned} 1 \text{ salpa} &= 100 \text{ cm} * 150 \text{ cm} \\ 1 \text{ salpa} &= 1000 \text{ mm} * 150 \text{ cm} \\ 1 \text{ strip} &= 5 \text{ mm} * 150 \text{ cm} \\ 100 \text{ purses} &= 100 \text{ strips} \\ 200 \text{ strips} &= 1 \text{ salpa} \end{aligned}$$

Figure 14

Process for making leather strips.

Painting the salpa	Cutting tool	Initial cut in the salpa	Cutting the salpa
			

Braiding the purse

This is the final stage in making a leather purse. Here, Lenin uses a strip of leather made in the previous step to braid the purse and join its two sides. First, he makes a diagonal cut on both ends of the leather strip to create a finer point that makes braiding easier. Then, he inserts one end of the strip into the first perforation on both sides of the purse (starting from the side where the slider stop is located after the sewing process) and gently slides it until the strip is evenly distributed between both sides of the purse.

Then he takes one of the ends, crosses it to the other side of the purse, and inserts it into the third hole on the front. Then, he inserts that same end into the second perforation on the back of the same side, applying some force to create tension on the strip to tighten it. A similar procedure is repeated with the

other end of the strip until all the perforations on both sides of the purse are covered.

When he reaches the end, the excess tapes should be inside the purse. Lenin takes one of the ends and passes it completely through the last perforation on both sides to ensure a good tie and prevent the braid from unravelling over time. Finally, to secure the tie, he cuts the excess tape with scissors, leaving approximately 1 cm if necessary, and applies the *boxer* to both ends to adhere them to the inside of the purse.

Figure 15 graphically illustrates a purse weaving process. To corroborate the information presented, evidence is also shown on the YouTube channel. Matemáticas del Pueblo [People’s math]. (2024, May 1). *Trenzado en un monedero* [Braiding a purse] [Video]. Youtube. <https://youtu.be/DVbmkCiio0M?si=S6Mb7T1KMqiphWCC>

Figure 15

Process for braiding a purse.

Beginning of braiding	Braiding process	End of braiding
		

Considering the data provided by the artisan, we can generally establish a relationship between the proposed measurement units and their usefulness in the production of leather purses, as shown in Table 2. Additionally, this table establishes the ethnomathematical connections (developed by the researchers) that occur at each stage of leather purse making.

Table 2.

Summary of the units of measurement used, equivalences, and ethnomathematical connections in the leather purse-making process.

Moments of making the purse	Units of measurement	Magnitud	Connections	Equivalents
Leather cutting	Decimeters	Length	• Simple rule of three • Units conversion • Distribution area calculation	1 purse = 2.5 decimeters 1 purse = 2 faces 1 face = 1.25 decimeters 100 purses = 200 faces 100 purses = 250 decimeters
Leather die-cutting	Stack	Quantity	• Division • Homogeneous distribution • Force	1 purse = 2 faces 1 face = 1 stack 100 purses = 2 stacks of 100 faces
Leather coating			• Uniform distribution.	
Cutting the zipper	Metre and centimetre	Length	• Rule of three • Measurement • Multiplication	100 purses = 17 m 100 purses = 1700 cm 1 purse = 17 cm
Applying the glue	Nail	Quantity	• Measurement • Proportionality	1 face = 1 nail 1 slide = 1 nail 1 purse = 3 nails 100 purses = 300 nails
Glueing the leather to the zipper tapes			• Counting and classification • Combination	
Integrating the slider into the zipper teeth		Quantity	• Symmetry	1 purse = 1 slider 100 purses = 100 sliders
Sewing the purse			• Symmetry • Logical sequence.	

Purse hole punching		Quantity	• Location and symmetry of the stitches • Angles and alignment • Depth and force measurement • Patterns	1 face = 16 holes 1 purse = 32 holes 100 purses = 3200 holes
Making strips for braiding	Millimeter and Centimeter	Length	• Area measurement and calculation • Division and proportion • Repetition	
Braiding the purse			• Sequences and ordered steps • Equitable distribution • Shapes • Tension and force • Measurement • Patterns	

CONCLUSIONS AND DISCUSSION

Making leather purses involves different mathematical processes, such as measurement systems, simple cross multiplication, symmetries, unit conversion, distribution, area calculation, division, multiplication, proportionality, counting, classification, combination, logical sequence, patterns, equivalences, angles, nails, gestures and stacks, which were mentioned in Table 2, in which we consider that they can have a positive impact when addressed in mathematics education.

By studying the practice of the craftsman Lenin, we could identify that some units of measurement are similar to those used by Rey Muños and Aroca Araújo (2011), Rodríguez-Nieto et al. (2022), Rodríguez-Nieto et al., (2019a), and Aroca Araújo et al. (2022), but during the actual making of leather purses, they are used differently and have other characteristics, among which the

equivalences stand out, which can enrich mathematical language in everyday terminology, such as nail and stack, and by using the hands as references for measurements. In addition to the units of measurement, similar symmetry systems are also presented and can be identified in Paternina-Borja et al. (2020) and Aroca (2016). This happens because each town has a different culture and develops its own mathematics (Gerdes, 2013).

We should note that only one artisan was interviewed in this investigation, who mentioned that he is the only one in the municipality of Soledad who makes this type of purse. However, they are also made in other places along the Colombian Caribbean coast. Therefore, we recommend expanding the research to other Colombian and Latin American populations to analyse different characteristics and consider other methods, techniques, languages, tools, and so on.

The research conducted could be adapted to lesson plans, particularly in systems of measurement and equivalences, with great potential for effective integration into classes. This approach can enter into dialogue with the basic standards of competencies and fundamental learning rights established in the Colombian educational curriculum. Measurement systems can be leveraged for teaching-learning-action purposes, as this practice demonstrates how measurement, in all its various forms, helps ensure that everything is in order and operating optimally in different settings, enhancing people's cognitive abilities by facilitating organisation, analysis, and effective problem-solving. By incorporating interactive activities like this into the classroom, students can better understand mathematical concepts and see how they apply to real-life situations.

When mathematics is taught in a way that connects to practical contexts, it becomes more meaningful. It helps students develop key skills to face challenges in their future careers and personal lives. Just like Morán et al. (2024) say: "By leveraging meaningful learning, educators can foster not only an appreciation for mathematics, but also the competencies needed to approach real-world problems with confidence and creativity" (p. 3254). Therefore, by engaging in these practical activities, we can create a rich environment for developing didactic proposals that enable students to apply mathematical knowledge in their daily lives.

On the other hand, we must keep in mind that this article, through the ethnomathematical approach proposed by Aroca (2022), provides fundamental elements of mathematics education to connect curriculum topics with specific cultural practices. We emphasise again that mathematics is a cultural

construction created, developed, and shared by communities, and is not limited solely to what appears in school books (Rodríguez et al., 2019).

AUTHORSHIP CONTRIBUTION STATEMENTS

The three authors, KPJ, SVO, and AAA posed the research problem. KPJ and SVO carried out the data collection and analysis. The introduction was written by KPJ; the methodological design was adapted from a proposal by AAA; KPJ and SVO developed the results and drafted the article. AAA fully reviewed the article and guided all research.

DATA AVAILABILITY DECLARATION

The evidence that supports the observations that this work has entailed is kept by Armando Aroca, who will give access to it upon reasonable request.

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