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The conceptual diversity of the pound from an ethnomathematical perspective

Moisés David Asís Mantilla [a]
Mauricio García Angulo [a]
Armando Alex Aroca Araújo [b]

[a] Universidad del Atlántico, Programa de pregrado Licenciatura en Matemáticas, Puerto Colombia, Atlántico, Colombia
[b] Universidad del Atlántico, Licenciatura en Matemáticas, Puerto Colombia, Atlántico, Colombia

ABSTRACT

Background: The research problem involved identifying people's diverse conceptions of the pound. **Objective**: The main objective of the research was to understand people's conceptions of the pound as a unit of measurement, the meaning they assign to it, its origin, the ways of measuring this unit, its uses, among other aspects, taking into account different contexts. **Design**: The research is theoretically supported by the Programa Etnomatemática and research on related topics. **Setting and Participants**: This research was conducted in Barranquilla, Atlántico Department, Colombia. Twenty participants agreed to collaborate in this study. **Data collection and analysis**: The methodology used was qualitative, with ethnographic characteristics. Semi-structured interviews, participant observation, and audiovisual recording were used for data collection. The information was analysed using categories. **Results**: Among the findings were the variety of conceptions held about the pound, the impartiality of this term, and the influence of labour on these conceptions. **Conclusion**: The discussion included a review of the information collected through the assessment of the mathematical ideas presented. The mathematical ideas present in the conceptions about the pound revealed that they can contribute to mathematics education from a contextualised approach.

Keywords: Programa Etnomatemática; Pound; Units of measurement; Cultural practices; Conceptions

La diversidad conceptual de la libra desde una perspectiva etnomatemática

RESUMEN

Contexto: El problema de investigación consistió en la identificación de las diversas concepciones que tienen algunas personas acerca de la Libra. **Objetivo**: El objetivo principal de la investigación fue comprender las concepciones que tienen las personas acerca de la Libra como unidad de medida, qué significado le asignan, su origen, las formas de medir esta unidad, sus usos, entre otros aspectos teniendo en cuenta diferentes contextos. **Diseño**: La investigación está respaldada teóricamente por el Programa Etnomatemáticas e investigaciones de temas a fines. **Escenario y**

Autor Correspondiente: Armando Alex Aroca Araújo. Email: armandoaroca@mail.uniatlantico.edu.co

Participantes: Esta investigación se llevó a cabo en la ciudad de Barranquilla del departamento del Atlántico. Se dispuso de veinte participantes que accedieron a colaborar en este estudio. **Recopilación y análisis de datos**: La metodología empleada fue cualitativa, con características etnográficas. Se utilizaron entrevistas semiestructuradas, observación participante y registro audiovisual para la recolección de datos. El análisis de la información se realizó a través de categorías. **Resultados**: Entre los hallazgos se destacaron la variedad de concepciones que se tienen sobre la Libra, la imparcialidad de este término y la influencia de la labor en las concepciones. **Conclusión**: La discusión incluyó una revisión de la información recolectada, valorando las ideas matemáticas presentadas. Se concluye que las ideas matemáticas presentes en las concepciones sobre la libra pueden aportar a la educación matemática desde un enfoque contextualizado.

Palabras clave: Programa etnomatemáticas; Libra; Unidades de medida; Practicas culturales; Concepciones

INTRODUCTION

This research paper analysed people's different understandings of the pound as a unit of measurement and how it is used in their daily work. The ethnomathematical connections present in both the pound and units of measurement in general were also studied.

PROGRAMA ETNOMATEMÁTICA

This study is theoretically grounded in Programa Etnomatemática because of the theoretical and methodological support it provides for understanding the conceptual diversity people have regarding the pound. Rosa and Orey (2005) propose Programa Etnomatemática as a field of research that can be described as the study of the history of mathematical ideas and practices found in diverse and specific cultural contexts. By viewing ethnomathematics as a research program, we enter a broader context that allows us to examine mathematics not only from a disciplinary perspective but also from social, cultural, and historical ones. This was confirmed by examining the diverse understandings of the pound in various social practices, which will be presented in the results later.

Programa Etnomatemática can be viewed from different perspectives, including educational, historical, research, economic, sociocultural, and others. D'Ambrosio (2019), for example, conceives of ethnomathematics as the mathematics practised by cultural groups, such as Indigenous societies, groups of workers, professional classes, and children of a certain age, among other groups identified by common objectives and traditions. Peña-Rincón et al. (2015) state that:

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> Ethnomathematics studies how knowledge is produced in the practices of communities and groups that respond to diverse ways of life and that develop from the need to survive and transcend, both in time and space (p. 139)

On the other hand, Ngilawayan and Pattiasina (2019) argue that ethnomathematics is innovative because it enriches mathematical learning through cultural knowledge and can be connected to the curriculum. Taking into account the above, the second phase of this research is to problematise in mathematics classes the research results that are presented in this article, through a didactic approach of Programa Etnomatemática proposed by Aroca (2022).

Programa Etnomatemática can be a form of mathematics education; thus, it can be interpreted as a transdisciplinary and transcultural epistemologically based research program with didactic implications (Aroca, 2022). Programa Etnomatemática has an educational purpose with a transformative feeling. D'Ambrosio (2014) raises the following:

> The relationship between mathematics education and ethnomathematics is natural because mathematics education aims to prepare young people and adults for critical citizenship, living in society, and developing their creativity (p. 106).

According to Gerdes (2013), Programa Etnomatemática is a research program responsible for revealing and assessing the mathematical ideas inherent in the diverse daily experiences of all peoples, social groups, and human cultures. Our experiences in this research involve the pound, generating mathematical knowledge by analysing measurements and tools that are uncommon in using this unit of measurement.

The Programa Etnomatemática provides us with various references to carry out this study, as well as the maturity and humility necessary to identify and value the knowledge and thoughts of social and cultural groups that have developed over time, generating ideas, measurements, calculations, interpretations, gestures, etc. that can be seen as an object of study; in this case, to assume the conceptions that people have about the pound with respect and through dialogue.

HISTORICAL CONTEXT OF THE POUND

Since the birth of civilisation, comparisons have been fundamental. This comparison is deeply associated with the concept of magnitude, and it is

evident that societies throughout history have used different standards for comparing magnitudes in their everyday activities. "…The human body was probably the first measuring device used in all cultures" (Bishop, 1999, p. 55).

Due to the need for counting, initial measurement systems were developed and subsequently refined. This can be supported by the opposing argument presented by Kula, which is outlined below.

> Simplifying the question and approaching it from an evolutionary viewpoint, we can affirm that the first evolutionary period of human metrological notions is the anthropometric one, in which the basic units of measurement are parts of the human body. The following period seeks its units of measurement in the conditions, objects, and results of human labour. The development of the metrological system and its components was influenced by the prevailing living and working conditions (Kula, 1999, p. 5).

When discussing the origin of measurement, we must go back to very ancient times, where Indigenous peoples practised using body parts to estimate measurements and establish patterns. According to the Ministerio de Educación Nacional de Colombia [Ministry of National Education of Colombia] (MEN, 2006):

> Historically, metric thinking was perfected with the refinement of units of length measurement, which were initially derived from body parts and were therefore highly diverse across regions and cultures. These units were then standardised for trade and industry (p. 63).

The above suggests a plurality of measures initially designed by indigenous peoples, which are still in effect today in various communities. We can easily find many people today who appear to be *holding the weight in their hands*.

> In the past, the use of the pound varied depending on the context and the type of product being purchased. For example, heavier pounds were used to measure meat, while lighter pounds were used for wax. The pharmacopoeia used the smallest pound, equivalent to 12 ounces. This reflects how cultural practices determined differences in measurement systems (Castaño, 2015).

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Although Alan Bishop does not write directly about ethnomathematics, he is frequently associated with this area as he is interested in the different activities and processes that lead to the development of mathematics, and which, in turn, pave the way for the analysis of mathematical ideas specific to social and cultural groups. “Measuring is the third ‘universal’ and important activity for the development of mathematical ideas and deals with comparing, ordering, and quantifying qualities that have value and importance” (Bishop, 1999, p. 55). This research also focuses on the activity of measuring, since the concepts analysed are functionally based on this process. Measuring is an activity used to develop an understanding of the pound and other units of mass.

The following research paper arises from an interest in understanding the different popular perceptions of the pound in the city of Barranquilla. The challenge is to identify the different views people have on the pound as a unit of measurement, and the overall objective is to analyse and understand these concepts and their relationship to ethnomathematics in order to strengthen these ideas and make them known.

“GOVERNMENT EMPIRES”: THE SIC AND ITS WAR ON THE POUND

The Superintendencia de Industria y Comercio (SIC) [Superintendency of Industry and Commerce], attached to the Ministerio de Comercio, Industria y Turismo del Gobierno de Colombia [Ministry of Commerce, Industry, and Tourism of the Government of Colombia], is the entity responsible for regulating, in this case, the measures used in the formal and informal commercial sectors. In May 2024, the SIC began various political and administrative moves to consolidate the metric system's hegemony over the pound. These movements exhibit all the characteristics of an epistemicide, as they aim to destroy deeply rooted social practices and concepts within the commercial customs of the country’s small merchants. The SIC, protected by Decree 1074 of 2015, modified by Decree 1595 of 2015, whose numeral 92 of article 2.2.1.7.2.1., defines the International System of Units (SI) as “the system of units based on the International System of Quantities (ISQ) with the names and symbols of the units, and with a series of prefixes of their names and symbols, as well as rules for their use, adopted by the Conferencia General de Pesas y Medidas (CGPM) [General Conference of Weights and Measures]”, and thinking more about the “confusion that it can generate to foreign visitors,” began a campaign in markets and commercial squares of some cities in the country to “raise awareness” among merchants to stop using the pound. Figure 1 shows a publication by the SIC on its social network X.

Figure 1.

Publication in X of the SIC: "Madam, sell me a pound of meat." Campaign against the use of the pound. (SIC, 2024)



There was also extensive dissemination through national and regional media, a sample of which can be seen in Figure 2.

Figure 2.

Mass media coverage of the non-use of the pound (EL TIEMPO, 2024; infobae, 2024)



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Beyond the mockery generated by the proposal to buy meat in grams – *"Madam, sell me 20 grams of meat,"*[1] "Now the country's problems are solved," etc., this shows an ignorance of traditions, of customs, that do not affect the average citizen at all. What is evident in this campaign is the disregard for the metric concepts and customs of the region's small merchants. This is evident in the failure to take into account the procedures employed, since most use the pound to market their products.

According to Castaño (2015), traditional measurements tend to resist change, since any modification can affect the practices established by merchants, who adapted measurement systems, such as the weight of meat or the amount of wine, to maximise their profits.

THEORETICAL BACKGROUND

Programa Etnomatemática includes some related research regarding the comparison and measurement of magnitudes, such as the following[2]: Measurement processes in a craft practice in the Colombian Caribbean. Measurement and estimation of bricklayers, a contribution to mathematics education (Rey & Aroca, 2011). Ethnomathematics in Indigenous education: This is how it is conceived, this is how it is put into practice (Ávila, 2014). Sundanese ethnomathematics: Mathematical activities in estimating, measuring, and making patterns (Muhtadi, Sukirwan et al., 2017). The compression measurement lesson in the 6th-grade fundamental education at the Escola Indígena Kanamari Maraã, AM, Brazil (De Oliveira & Mendes, 2017);

[1] We clarify that in Colombia, the expression "*me regala*" means "*me vende*" (sells me).

[2] The original titles are, respectively: Procesos de medición en una práctica artesanal del caribe colombiano. Medición y estimación de los albañiles, un aporte a la educación matemática (Rey y Aroca 2011); La etnomatemática en la educación indígena: así se concibe, así se pone en práctica (Ávila, 2014); Sundanese ethnomathematics: Mathematical activities in estimating, measuring, and Making Patterns (Muhtadi, Sukirwan et al.; 2017); O ensino de medida de comprimento no 6º ano do ensino fundamental na Escola Indígena Kanamari Maraã, AM, Brasil (De Oliveira & Mendes, 2017). Los sistemas de medida en la comunidad Arhuaca: su uso en distintos contextos (Trujillo-Varilla et al., 2018), Procesos de medición en una práctica artesanal del caribe colombiano. Un estudio desde la etnomatemática (Rodríguez-Nieto et al., 2019); Dos sistemas de medidas no convencionales en la pesca artesanal con cometa en Bocas de Cenizas (Rodríguez-Nieto et al., 2019); Un enfoque didáctico del Programa Etnomatemáticas (Aroca, 2022). Etnomatemática: Medidas no convencionales en libros de texto mexicanos: Un análisis desde la etnomatemática y el enfoque ontosemiótico (Morales & Rodríguez, 2022).

Measurement systems in the Arhuaca community: their use in different contexts (Trujillo-Varilla et al., 2018); and Measurement processes in a craft practice in the Colombian Caribbean. A study from ethnomathematics (Rodríguez-Nieto et al. 2019). Two non-conventional measurement systems in artisanal kite fishing in Bocas de Cenizas (Rodríguez-Nieto et al., 2019); A didactic approach to the Programa Etnomatemática (Aroca, 2022); and Ethnomathematics: Unconventional measurements in Mexican textbooks: An analysis from ethnomathematics and the ontosemiotic approach (Morales & Rodríguez, 2022). However, we want to highlight the research by Aroca, Cantillo, and Pupo (2022), who question the use of the expression "unconventional" by asking: What do we mean by a system of measurement? What would conventional mean? What would unconventional mean? Is the use of "UN" (no) a power relationship? What would happen if we take into account not only the classroom but also craft practices and everyday life?

METHODOLOGY

This research is of a qualitative-descriptive type, characterised by following a method with ethnographic characteristics. The methodology employed was based on the development of the seven sub-phases that comprise the ethnographic phase of the didactic approach of the Programa Etnomatemática, as proposed by Aroca (2022).

Below, each of the seven sub-phases that comprise the ethnographic phase of the research is methodologically described.

PRIOR KNOWLEDGE

For the development of this sub-phase, a bibliographic analysis was conducted (Gómez-Luna et al., 2014) on the origin of units of measurement in general, with a particular focus on the pound and its various forms of measurement and conceptualisation throughout history, in order to compare the different cultural practices in which the pound is used. After analysing the literature, the contexts for interviewees were carefully selected. These interviewees had to be individuals who had a relationship with units of measurement, especially the pound, in their work or occupation. The interviewer and the interviewees mutually agreed to participate in the interviews. The general data of the selected interviewees are presented in Table 1, including only the first name, gender, occupation, and practice. Acronym E1 refers to the first interviewee, E2 to the second, and so on. At the request of some respondents, some names were omitted (NN).

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Table 1

General data of the interviewees. (Compiled by authors)

#	Interviewee	Gender	Occupation	Context
E1	Dennis	F	Chef	Kitchen
E2	Amaury	M	Shopkeeper	Commerce
E3	Santos	M	Fishmonger's employee	Commerce
E4	Eduardo	M	Fishmonger's employee	Commerce
E5	Bolo	M	Fishmonger's employee	Commerce
E6	Herrera	M	Fishmonger's employee	Commerce
E7	Moisés	M	Greengrocery salesperson	Commerce
E8	Jairo	M	Former weight and measure inspector	Commerce
E9	Jairo	M	Greengrocery salesperson	Commerce
E10	Juan	M	Seller of Avocados	Commerce
E11	NN	M	Greengrocery salesperson	Commerce
E12	Elías	M	Fruit and vegetables salesperson	Commerce
E13	Leonardo	M	Greengrocery salesperson	Commerce
E14	Virgilio	M	Yucca and yam vendor	Commerce
E15	Luis	M	Personal trainer	Sport/Gym
E16	Jose	M	Athlete	Sport/Gym
E17	Samuel	M	Chemistry student	College
E18	NN	F	Seasoning saleswoman	Commerce
E19	Nubia Cabrera	F	Grain vendor	Commerce
E20	Darío	M	Banana vendor	Commerce

Note. F = Female; M = Male.

PLACE

Regarding the selection of locations, we considered Atencio, Gouveia, and Lozada's (2011) proposal. We selected Barranquilla, in northern Colombia, as the main location for our study. Within this area, we chose three key locations to cover various possible contexts: Barrio Las Flores, Barranquilla Market, and the University of the Atlantic. These locations were selected due to their commercial, social, and cultural dynamism, with special emphasis on

commercial, sports, academic, and gastronomic activities. This strategic choice considerably facilitated the identification and interviewing of participants in our research.

INFORMATION COLLECTION METHODS

We employed a methodology that allowed us to use a variety of instruments, such as interviews, audiovisual recordings, and field notes.

> Considered a method, ethnography is a study in context where face-to-face relationships occur, with an intense presence of everyday life. Information is collected from various sources and is processed correctly when unity is established between the collector and the analyst (Bonilla, 2017).

Guided by ethnography, we undertake the task of creating categories and, based on observation, develop a semi-structured interview protocol that allows us to gain a close-up look at both the interviewee and the relationship between the pound and the work they do.

Immersion

Monroy and Narváez (2020) define research immersion as follows:

> Student immersion in research involves delving into a field to investigate concepts and processes, acquiring knowledge that enables the identification and resolution of various problems.

In this context, the fieldwork conducted in the Las Flores neighbourhood, the Barranquilla Market, and the University of the Atlantic precisely adhered to this principle, aiming to engage with the spaces and people integral to these everyday environments.

To conduct the interviews, we chose various locations that were representative of everyday life in the Las Flores neighbourhood. The first interview took place at Mrs Dennis's home, providing a gastronomic insight into the term "pound." Later, we extend our conversations to the local fishmonger, providing a closer look at the very heart of the commercial activity that defines this neighbourhood. In addition, we schedule interviews in the

pier, a crucial meeting point for the community and a representative store of the area. In this way, we could capture the diversity of ideas and perspectives that characterise the area's residents, providing a holistic view of the neighbourhood's social and economic reality.

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We then moved to the Barranquilla Market, where we encountered considerable resistance from local merchants, particularly in the banana market. As the vendors themselves explained, they feared the high extortion rates in the area. However, efficient interaction was achieved with many of them, which facilitated the conduct of the interviews (some of which were conducted only via audio). Days later, we visited the University of the Atlantic to analyse concepts about the pound in academic and sports environments.

Data analysis

Regarding data analysis, the proposals made by Hernández et al. were taken into account. (2014). We reviewed the information gathered during the investigation and made transcripts of the videos and audio recordings. In addition, we examined the captured photos. We detailed and classified the data by categories, establishing relationships between the information obtained and, in turn, identifying ethnomathematical connections present in them.

Audiovisual productions

According to Barros and Barros (2015), audiovisual media are communication media directly related to photography, images, and audio. They also highlight the connection of these media to teaching in terms of functionality and capacity. In addition to the written content of this article, various audiovisual productions were also made during the interviews. These videos were published on YouTube with the consent of the interviewees, on the channel *Matemáticas del Pueblo [People's Mathematics]*. See Figure 3.

Figure 3

QR code of the playlist with the audiovisual record that shows the fieldwork.

Figure 3 shows a QR code that links to all the audiovisual productions (videos and shorts) created during the development of this study. It includes Chapters 1 and 2 of the interviews, along with various short excerpts from these chapters, addressing the central question of the interviews: "What is the pound?"

Contributions to the community or the respondent

Guided by the ethical considerations in qualitative research proposed by Viorato and Reyes (2019), and following the publication of the audiovisual productions, access links were sent to each interviewee, greatly pleasing them. In some cases, they had never spoken in front of a camera and felt proud. This video will help them promote their activity and enable more people to see their work.

Regarding our social role as mathematics educators, this article concludes with various ethnomathematical connections to school mathematics, which can serve as a guide for the school community.

RESULTS

Within the ethnographic fieldwork with the respondents, we obtained different results from the analysis of the interviews. In total, 20 interviews were conducted, all of which were recorded through audiovisual means, such as videos, photos, and recordings. The results are classified below into the following categories:

- Knowledge and use of the pound.
- Tools for measuring the pound.
- Relationship of the pound with other units.
- The unit of measurement and its geographical context.
- Absence of the pound.

Knowledge and uses of the pound

When asked what the pound means to them and when they use the pound, the respondents answered:

Dennis (Chef): "Well, the pound, for us,/ we obviously use the pound for recipes// for, uh, the weights// especially when they are large orders/ because we use the pound… We normally do not use the pound// because we use nn weights / especially in recipes, they are grams."

Mrs Dennis, being a chef, relates the pound and its use to elements of cooking, such as recipes, weights, and grams.

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Amaury (Shopkeeper): A pound is five hundred grams// aro… I was taught/ that// a pound is five hundred grams/ every pound is five hundred grams… I use the pound when they ask for it/// ehh aa// in bulk/ for example, a pound of sugar, a pound of aa// of rice, a pound of cassava.

Mr Amaury, being a shopkeeper, relates the pound and its use with elements used in stores, such as grams, sugar, rice, and cassava.

Santos (Fishmonger's employee): Well, the pound (e')s// so to speak/// a pound (e')s is five hundred grams and// we always keep it as// as/ (for') the customers/// not aa// like they know that (e')s a pound of fish or// because if aa// I mean, I gave him five hundred grams//that is a pound, /// half a kilo.

Mr Santos, working in a fish market, relates the concept of the pound to elements present in his work, such as grams, kilos, and fish.

NN (Greengrocery salesperson): …Well, here we use the pound if it is green bell pepper, it is weighed by gram, that is, each green bell pepper weighs 5 grams and that makes a pound more or less, which is seven bell peppers; this, for example, weighs more (points to another product), this weighs a pound…

This answer indicates that the interviewee's relationship with the pound is primarily linked to his job of selling vegetables.

Conceptions of the pound in the interviews reflect a diversity of perceptions that vary according to occupational, educational, and regional context. That is, the respondents' conceptions of the term "pound" are directly dependent on their context, whether it be work, discipline, sport, or activities performed by the individual. The person answers these questions based on their lived experiences.

Tools for measuring the pound.

Currently, various tools serve not only to measure pounds but also other units of measurement. During the fieldwork, various tools for calculating pounds were identified, some of which are unusual. Figure 4 shows some of the tools mentioned and/or used in audiovisual recordings.

Figure 4

Tools for measuring the pound. (Audiovisual record)



2a. Mechanical scale.



2b. Digital scale.



2c. Analogue scale.

Mechanical hanging scale (2a): Device used by a cassava vendor in the Las Flores neighbourhood. It consists of a clock that measures pounds and grams, which is held by a hook that pulls a spring. With a metal base to place the products, it can weigh up to 25 kilograms (50 pounds) maximum. It is very common to see this type of scale on the streets, in informal businesses and with street vendors.

Digital or weight scale (2b): The device used in the store where interviewee Amaury works to weigh various types of products. This tool is a more modern scale that allows for measuring in different units and with greater precision, with a maximum weight of 40 kilograms (approximately 88 pounds). It is quite usual to see this type of scale in neighbourhood stores.

Analogue scale (2c): It is similar to a mechanical scale, but differs in that it is computerised, enabling measurements in different units and allowing for greater weights. It is common to see this type of scale in the fish markets of the Las Flores neighbourhood.

The interviewees also highlight other artefacts used for measurement, such as the hand scale, the 5-kilogram scale, and the scale made with a gourd, mentioned by interviewees E1, E8, and E14, respectively. Although these tools are no longer used today because they are outdated, many of them laid the groundwork for the metrics that led to the present.

Relationship of the pound with other units

The pound is a unit of weight with different relationships, and it is even possible to convert between different units of measurement, which is why we

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can relate and estimate the pound in relation to other units. Considering the research by Rodríguez and Aroca (2019), which compares unconventional measures, and the information from audiovisual records, different equivalences can be made. Within the framework of this study, various comparisons between units of measurement were identified; some of these are already standardised, while others depend on the context used.

Among respondents' conversions, we can highlight two types of equivalence: the first relates the pound to other formal units of measurement familiar to most of them, and the second involves equivalence composed of objects or products related to the interviewees' context.

Table 2

Equivalence of the pound with other units of measurement. (Compiled by authors)

Pound	Other units of measurement
1 pound	500 / 453.6 / 460 grams
1 pound	16 ounces
2 pounds	1 kilogram
25 lb	1 arroba
100 lb	1 hundredweight / 4 arrobas

Table 2 illustrates the various equivalences between the pound and other units of measurement. These relationships were established by most of the interviewees, not all, as some were unfamiliar with certain relationships or shared similar values. As for the other units of measurement, it is worth noting that two more were mentioned in the interviews but do not appear in this table, because their popular equivalences are in relation to the kilogram and not the pound. These units are the parcel (50 kilos) and the load (100 kilos).

Regarding the equivalence with objects or products related to the interviewees' context, we have two clear examples: the first is in the interview with Mr Eduardo (E4), where he compares the pound with the quantity of fish. Eduardo's words: "*Moreover, if the client says, 'Hey, I need a pound of fish,' we ask him, 'Do you want one fish that weighs one pound, or two that weigh half a pound, which equals 500 grams?' Then he says, 'No, give me this one that weighs a pound, or give me two that weigh a pound...*'" Another example can be seen in the interview with E11 when he says the following: *"...and there you get a pound or so, which is seven peppers (cooking chilli).*" Here, the vegetable seller estimates the value of a pound using a specific number of bell

peppers. Just as they are, it is common to find this type of comparison in this context, where products of one's own work are applied.

> The equivalences of units of measurement were not always uniform; for example, in our current mindset, it is assumed that a hundredweight must always consist of 100 pounds, each weighing 16 ounces. However, in the forges of Vizcaya, there were different types of hundredweights, and the law in 1452 established that these should be equivalent to 144 pounds of 16 ounces (Castaño, 2015).

These types of variations reflect the influence that context has on the equivalence of a unit of measurement, in this case, the pound, with other units of the same magnitude.

The unit of measurement and its geographical context

The use of units of measurement generally varies depending on where we are in the world, for various reasons, such as globalisation, ease of counting, trade relations, government regulations, traditions, or identity as a territory. In the interview with Mrs Dennis (E1), a clear example of this was evident, as she mentioned that in the city of Cartagena, the pound is not used as much. The chef's words: "Normally here in Colombia/ some cities use the pound just as some others where the pound is not used… For example, in Cartagena, [people] do not use the pound // Cartagena is a quarter, a kilo, half a kilo, three kilos // you will get to buy it and you do not buy by the pound." Amaury (E2) and Eduardo (E4) conclude that the value of the pound is the same throughout the world. Leonardo (E13) comments that, in his homeland, La Guajira, the pound is not widely used, and expresses that in the following way:

(E13). I am from La Guajira.

(I). Okay, and over there in La Guajira, have you also worked with the pound?

(E13). No.

(I). Don't they work by the pound there?

(E13). No, per kilo.

(I). Is it always per kilo? (E13). Yes, it's per kilo.

Luis (E15) and José (E16) believe that the value of 500 grams given to the pound is an approximation made to the real value to make it easier to handle by representing it in an integer value. José says: "…It is a popular thought that here they unified the pound as around 500 grams, so that it becomes easier for ordinary people to work with 500 grams, like...

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If it were a pound, which we see here in the more professional field, that a pound is not equivalent to 500 grams."

Seen from a university context, we met E17, who stated the following: "Well, I believe, what I believe, what I think is that the units of measurement are universal, that's why they are almost all the same in the same place, they don't vary unless it's in the United States, where they are a little selfish and like to have their own things." The implicit understanding of the relationship between Anglo-Saxon countries and the pound is highlighted, as is the failure to include other countries and Indigenous communities in an attempt to globalise the statement.

When analysing the labels of products offered by various supermarkets in the city of Barranquilla, we realise that the measurement in pounds on product labels is minimal, as almost all products measured in weight units are labelled only in kilograms or grams, and only a few products with equivalents in pounds or ounces are provided as an approximation. A powder detergent label was found to contain 7.7 pounds, equivalent to 3.5 kilograms; the rest had a kilogram-to-ounce ratio.

Figure 5

Shortage of pound measurements of products in Barranquilla supermarkets. (Audiovisual record)



Powder detergent with its conversion to pounds.



Powder detergent with its conversion to ounces.



Cookies with their conversion to ounces.



Oats with their conversion to ounces

The ounce as a unit of measurement is not widely understood, despite being widely used in the preparation of baby bottles. However, the ounce is the unit that appears most frequently in supermarkets when converting from the kilogram. Because most of these labels are written in English, they are primarily used for export and help foreign buyers better understand the content quantity. These conversions can confuse consumers, as in some cases the internationally regulated value of the pound (453.5 grams) is used, while in others, the Colombian regulated value for the pound (500 grams) is used.

Absence of the pound

During our fieldwork, we met individuals who do not use the pound in their practice because their products are marketed by quantity rather than unit weight. For example, E10, Mr. Juan, answered as follows when asked why he sold by quantity and not by weight: "*Yes, because some people here do not buy by the kilo because they say: give me just one… how much is it worth… give me $2,000, you know how it is and there it is what it weighs, because if it weighs $2,200 they have to give me $2,200.*" The avocado seller (E10) sells the avocados the same way he buys them. He does not use any scales at his workplace, even though he buys his product weighed. However, he sells it at the customer's discretion; that is, however the customer wants.

Another example of the absence of the pound can be seen in the interview with the banana salesperson (E20), who was asked why he did not sell his product by the pound, to which he replied as follows: "*Less work, easier to sell it that way because we also buy it that way*." Unlike E10, this one sells his product in the same way he buys it, by quantity, which makes things easier for him since he is already familiar with this concept.

Among the main results, the following stand out: the geographical importance of the pound, conceptions about the pound based on personal

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context, the variety of tools used for measuring the pound, empirical measurement of the pound, the relationship of the pound with other units of measurement, and the diversity of results in converting the pound.

CONCLUSIONS

The conceptual diversity of the pound can be analysed from the following categories:

- Concept related to the work or activity practised (Cpound-01)
- Concept related to the standard value in Colombia (Cpound-02).
- Concept related to non-regularised values in Colombia (Cpound-03).
- Concept related to other units of measurement (Cpound-04).

Table 3

Conceptual diversity of the pound. (Compiled by authors)

Category	Interviewee
C_{pound}-01	E1, E4, E9, E11
C_{pound}-02	E2, E3, E5, E6, E7, E12, E18, E19
C_{pound}-03	E8, E16, E17
C_{pound}-04	E10, E13, E14, E15, E20

Furthermore, the versatility of the term “pound” is highlighted, as it holds varying degrees of importance depending on the individual’s geographical location. On the other hand, we also noted that people’s conceptions of the pound will be significantly influenced by the tasks they perform daily. This research highlights the importance of units of measurement, particularly the pound, as it is the most prevalent in our Colombian environment in everyday life.

Because this research focuses solely on the context of Barranquilla, this could be seen as a limitation, as expanding the geographic scope would likely increase the number of conceptions and yield even more significant results. That is why this research opens the way for other possible studies, not only in the context of Barranquilla but throughout the region, where the tools and units to analyse would be greater.

Considering the research results, we can observe the importance of units of measurement in society, such as the pound, a unit standardised in different ways depending on the context and used to control sales according to quantity, as well as in recipe preparations. What we can notice is that few people are aware of the different measurements used in other countries, which we can reinforce in schools by showing the pound as an example.

As we can observe, the pound is related to other internationally standardised weight units, such as the kilogram, or another measurement specific to the pound, which is the ounce. For commercial purposes or food preparation, we sometimes find different units, so we use a conversion factor. In the interviews, we can notice the relationships that some detail, such as the pound as 12 ounces, it is half a kilogram, it is 500 grams, among others... to teach the use of the conversion factor and its importance, it is convenient to take into account the different perceptions of the pound since this introduces us to demonstrate the need for data to solve a problem that requires this and the context of the approach, such as, in this way, the student becomes involved in the conversion and, therefore, problem solving. *Acta Latinoamericana de Matemática Educativa* (2011) concludes: "In general, research shows that in contextualised situations, the problem and the solution are generated simultaneously and the person is cognitively, emotionally, and socially involved."

On the other hand, knowing that here in Colombia the pound was rounded to 500 grams for greater ease of counting as a whole value or half a kilo, compared to the international system, where one pound is equivalent to approximately 453.59 grams, we can conclude that this was rounded to facilitate its measurement with other processes, as in other countries.

Considering the importance of rounding, "Rounding numbers is a compelling and efficient strategy for estimating results. Its main purpose is to produce numbers that can be easily handled," as stated by Cortés, Backhoff, and Organista (2005). Thus, a

lesson we learn from this is that in mathematics education can emphasise this rounding process. The teaching of rounding is important, given its connection to life itself. The topic could even be contextualised with the use of the pound in various countries.

The results presented here can contribute to mathematics education, as they enable the design of contextualised didactic situations that support the teaching-learning process in the classroom. This, in turn, helps develop

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students' metric thinking and measurement systems, as well as their appreciation of social practices and historical and cultural roots.

AUTHORSHIP CONTRIBUTION STATEMENTS

The three authors, MDAM, MGA, and AAAA, proposed and designed the research project that led to this research article. MDAM and MGA collected the data and developed the first draft of the article. AAAA reviewed the document several times and made the necessary corrections. The conclusions and the remaining aspects of the article were the work of the three authors.

DATA AVAILABILITY DECLARATION

The evidence supporting the observations made in this work is kept by AAAA and can be accessed upon reasonable request.

REFERENCES

Aroca, A., Cantillo Fuentes, L., & Pupo Paba, N. (2022). ¿Qué entendemos por sistema de medidas? Una perspectiva Etnomatemática. *Amauta, 20*(40), 25-44. https://doi.org/10.15648/am.40.2022.3128

Aroca-Araújo, A. (2022). Un enfoque didáctico del programa de Etnomatemáticas. *Tecné, Episteme y Didaxis: TED*, (52), 211- 248. http://doi.org/10.17227/ted.num52-13743

Atencio Ramírez, M., Gouveia, E. L., & Lozada, J. El trabajo de campo estrategia metodológica para estudiar las comunidades. *Omnia, 17*(3), 9-22.

Ávila, A., (2014). La etnomatemática en la educación indígena: así se concibe, así se pone en práctica. *Revista Latinoamericana de Etnomatemática, 7*(1), 19-49.

Barros Bastida, C., & Barros Morales, R. (2015). Los medios audiovisuales y su influencia en la educación desde alternativas de análisis. *Revista Universidad y Sociedad, 7*(3), 26-31.

Benítez-Pérez, A. (2011). La importancia de los eventos contextualizados en el desarrollo de competencias matemáticas. En P. Lestón (Ed.), Acta Latinoamericana de Matemática Educativa (pp. 51-60). *Comité Latinoamericano de Matemática Educativa y Colegio Mexicano de Matemática Educativa A. C.*

Bishop, A. (1999). *Enculturación matemática*. La educación matemática desde una perspectiva cultural. Paidós.

Bonilla, M. D. C. (2017). *El Método etnográfico en una investigación etnomatemática en comunidades indígenas peruanas*. http://funes.uniandes.edu.co/21391/1/Bonilla2017El.pdf

Castaño, J. (2015). *EL LIBRO de los PESOS y MEDIDAS*. La esfera de los libros.

Cortés, J., Backoff, E., & Organista, J. (2005). ANÁLISIS DE ESTRATEGIAS DE CÁLCULO ESTIMATIVO EN ESCOLARES DE SECUNDARIA CONSIDERADOS BUENOS ESTIMADORES. Revista Mexicana de Investigación Educativa, 10(25), 543-558.

D'Ambrosio, U. (2014). Las bases conceptuales del Programa Etnomatemática. *Revista Latinoamericana de Etnomatemática, 7*(2), 100-107.

D'Ambrosio, U. (2019). *Etnomatemática – Elo entre as tradições e a modernidade*. Autêntica.

De Oliveira Júnior, B., & Mendes dos Santos, E. (2016). Etnomatemática: O ensino de medida de comprimento no 6º ano do ensino fundamental na Escola Indígena Kanamari Maraã-AM, Brasil. *Revista Latinoamericana de Etnomatemática, 9*(2), 53-66.

EL TIEMPO. (16 de mayo de 2024). *La carne y otros alimentos no se seguirían vendiendo por libras en Colombia: SIC explica por qué*. https://www.eltiempo.com/economia/finanzas-personales/sic-explica-que-la-carne-y-otros-alimentos-no-se-deben-vender-por-libras-en-colombia-por-que-3343386#:~:text=%C2%BFSab%C3%ADas%20que%20la%20libra%20no,del%20sistema%20internacional%20de%20unidades%3F&text=De%20esta%20forma%2C%20el%20gramo,una%20libra%20son%20500%20gramos

Gerdes, P. (2013). *Geometría y Cestería de los Bora en la Amazonía Peruana*. Lima: Ministerio de Educación. https://www.etnomatematica.org/home/wp-content/uploads/2014/05/libro_bora.pdf

Gómez-Luna, E., Fernando-Navas, D., Aponte-Mayor, G., & Betancourt-Buitrago, L. A. (2014). Metodología para la revisión bibliográfica y la gestión de información de temas científicos, a través de su estructuración y sistematización. *Dyna, 81*(184), 158-163. http://dx.doi.org/10.15446/dyna.v81n184.37066.

ACTA SCIENTIAE
(cc) BY
ISSN: 2178-7727
DOI: 10.64856/acta.scientiae.8169

Hernández Mendo, Antonio., Castellano, Julen., Oleguer Camerino, Oleguer., Jonsson, G, K., Blanco-Villaseñor, Angel., y Lopes, Antonio. (2014). Programas informáticos de registro, control de calidad del dato, y análisis de datos. *Revista de psicología del deporte, 23*(1), 111-121. https://ddd.uab.cat/record/119078.

infobae. (15 de mayo de 2024). *La carne y otros alimentos ya no se pedirán en "libras": esto explicó la Superintendencia de Industria y Comercio*. https://www.infobae.com/colombia/2024/05/16/la-carne-y-otros-alimentos-ya-no-se-pediran-en-libras-esto-explico-la-superintendencia-de-industria-y-comercio/

Kula, W. (1999). *LAS MEDIDAS Y LOS HOMBRES*. Siglo veintiuno editores.

Laurens, T. Ngilawayan, D., & Pattiasina, J. (2019). Ethnomathematics Study of Islands Indigenous Peoples in Maluku Provinces, Indonesia. *Jurnal Pendidikan Progresif, 9*(1), 113-122. http://dx.doi.org/10.23960/jpp.v9.i1.201914.

Ministerio de Educación Nacional [MEN]. (2006). Estándares básicos de competencias en lenguaje, Matemáticas, ciencia y ciudadanas. Bogotá, Colombia: MEN.

Monroy Silva, M. V., & Narváez Zabala, L. L. (2020). Inmersión en la investigación. Semilleros de investigación como estrategia formativa en la investigación. Caso de estudio: proyecto valoración de la fuerza de agarre y de pinza con dinamometría isométrica en población adulta de bogotá. *Encuentro Internacional De Educación En Ingeniería*. https://doi.org/10.26507/ponencia.759.

Morales-Garcia, L., & Rodríguez-Nieto, C.A. (2022). Medidas no convencionales en libros de texto mexicanos. Un análisis desde la Etnomatemática y el enfoque Ontosemiótico. *REDIMAT – Journal of Research in Mathematics Education,11*(1), 33-70. https://doi.org/10.17583/redimat.8646

Muhtadi, D., Sukirwan, Warsito, & Prahmana, R.C.I. (2017). Sundanese Ethnomathematics: Mathematical Activities in Estimating, Measuring, and Making Patterns. *Journal on Mathematics Education, 8*(2), 185-198. http://dx.doi.org/10.22342/jme.8.2.4055.185-198

Peña-Rincón, Pilar, Tamayo-Osorio, Carolina, & Parra, Aldo. (2015). Una visión latinoamericana de la etnomatemática: tensiones y desafíos.

Revista latinoamericana de investigación en matemática educativa, 18(2), 137-150. https://doi.org/10.12802/relime.13.1820.

Rey Muñoz, M. F., y Aroca Araújo, A. (2011). Medición y estimación de los albañiles, un aporte a la educación matemática. *Revista U.D.C.A Actualidad & Divulgación Científica, 14*(1), 137-147. https://doi.org/10.31910/rudca.v14.n1.2011.766

Rodríguez Nieto, C., Mosquera García, G., & Aroca-Araujo, A. (2019). Dos sistemas de medidas no convencionales en la pesca artesanal con cometa en Bocas de Cenizas. *Revista Latinoamericana De Etnomatemática Perspectivas Socioculturales De La Educación Matemática, 12*(1), 6-24.

Rodríguez-Nieto, C. A., Aroca-Araújo, A. A., & Rodríguez-Vásquez, F. M. (2020). Procesos de medición en una práctica artesanal del caribe colombiano. Un estudio desde la etnomatemática. *Revista Latinoamericana De Etnomatemática Perspectivas Socioculturales De La Educación Matemática, 12*(4). https://doi.org/10.22267/relatem.19124.36.

Rosa, M., & Orey, D. (2005). Las Raíces Históricas del Programa Etnomatemáticas. Revista Latinoamericana de Investigación en Matemática Educativa, *RELIME, 8*(3), 363-377.

Superintendencia de Industria y Comercio. (13 de mayo de 2024). *¿Sabías que la libra no hace parte del sistema internacional de unidades?* [Post] [Imagen adjunta].X. https://x.com/sicsuper/status/1790124863220560267

Trujillo Varilla, O. E., Miranda Viramontes, I., & De la Hoz Molinares, E. E. (2018). Los sistemas de medida en la comunidad Arhuaca: su uso en distintos contextos. *Revista Latinoamericana De Etnomatemática Perspectivas Socioculturales De La Educación Matemática, 11*(2), 31- 51.

Viorato, N., & Reyes, V. (2019). La ética en la investigación cualitativa. *CuidArte, 8*(16),35-43. http://dx.doi.org/10.22201/fesi.23958979e.2019.8.16.70389.