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Statistical tables in Primary Education textbooks of Peru

Tablas estadísticas en libros de texto de Educación Primaria del Perú

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Abstract
In recent years, the literature shows an increase in research analyzing statistical representation of data in textbooks, but in the Peruvian context is still scarce. Therefore, this research aims to analyze activities on statistical tables present in mathematics textbooks, published by the Ministry of Education and distributed free of charge to teachers and students of Primary Education in Peru. The methodology is qualitative and descriptive. For data analysis, the content analysis technique was used by analyzing types of statistical table, types of task, reading levels and semiotic complexity levels as units of analysis in a complete series of mathematics textbooks of Primary Education, from first to sixth grade, one per level, due to their wide national coverage. The results allow us to observe predominance of tally charts and data tables, completion and comparison tasks, reading level 2 (reading within data) and semiotic complexity level 3 (representation of data distribution). It is concluded that it is necessary to increase the number and variety of tasks related to statistical tables proposed in mathematics textbooks, as well as to reinforce the presence of the highest levels of reading and semiotic complexity in the last years of Primary Education in Peru.

Resumen
En los últimos años, la literatura evidencia un aumento de investigaciones que analizan representaciones estadísticas en libros de texto, pero en el contexto peruano estas aún son escasas. Es por esto, que esta investigación tiene por objetivo analizar las actividades sobre tablas estadísticas presentes en los libros de texto de matemática, editados por el Ministerio de Educación y distribuidos gratuitamente a docentes y estudiantes de Educación Primaria en Perú. La metodología es cualitativa y de nivel descriptivo. Para el análisis de los datos se utilizó la técnica de análisis de contenido, analizándose las unidades de análisis, como tipos de tabla estadística, tipos de tarea, niveles de lectura y niveles de complejidad semiótica presentes en una serie completa de libros de texto de matemática de Educación Primaria, de primero a sexto, uno por nivel, debido a su amplia cobertura nacional. Los resultados permiten observar el predominio de las tablas de conteo y de datos, de las tareas de completar y comparar, del nivel de lectura 2 (leer dentro de los datos) y del nivel de complejidad semiótica 3 (representación de una distribución de datos). Se concluye que es necesario ampliar la cantidad y variedad de tareas relacionadas con tablas estadísticas propuestas en los libros de texto de matemática, así como fortalecer la presencia de los últimos niveles de lectura y complejidad semiótica en los últimos cursos de Educación Primaria en Perú.

Keywords / Palabras clave
Statistics, mathematics, statistics education, mathematics education, textbooks, teaching materials, data visualization, primary education.
Estadística, matemáticas, enseñanza de la estadística, Enseñanza de las matemáticas, libro de texto, material didáctico, visualización de datos, enseñanza primaria.

1. Introduction

One essential knowledge in the education of citizens, both for their social participation and decision-making, is statistics, particularly, basic representations such as statistical tables or graphs, which are frequently used in the media (Arteaga et al., 2011; Gal, 2011; Jurečková & Csachová, 2020). This situation requires educational centers to train citizens with an adequate statistical culture. This implies that people develop the skills to:

> (…) read and interpret tables, graphs and summary measures that appear in the media; interpret, critically evaluate, and communicate statistical information; understand and use the language and basic tools of statistics; appreciate the value of statistics in everyday life, civic life and professional life as a consumer of data (Del Pino & Estrella, 2012).

From a curricular point of view, and taking into account international trends, the National Ministry of Education of Peru (MINEDU) has defined the national curriculum of Basic Education – at the early, primary and secondary level – by competence, understood as “the faculty that a person has to combine a set of abilities in order to achieve a specific purpose in a given situation, acting in a pertinent and ethical way” (MINEDU, 2016, p. 192). In particular, Primary Education is made up of three stages: Stage III (1st and 2nd grade), Stage IV (3rd and 4th grade) and Stage V (5th and 6th grade).

Mathematics area is made up of four competences: 1) Solving quantity problems; 2) Solving problems of regularity, equivalence, and changes; 3) Solving problems of form, movement and location; 4) Solving data management problems and uncertainty. Teaching of statistical tables is linked to the last competence, the purpose of which is:

> (…) For the students to analyze data on a topic of interest or study of random situations, which allows them to make decisions, develop reasonable predictions and conclusions supported by the information produced. To do this, the students collect, organize and represent data that provide inputs for the analysis, interpretation and inference of their deterministic or random behavior using statistical and probabilistic measures (MINEDU, 2016, p. 263).

To address this competence, which is worked on from the first year of Primary Education, it is necessary for students to develop the following skills (MINEDU, 2016, p. 141): 1) Represent data with graphs and statistical or probabilistic measures; 2) Communicate understanding of statistical and probabilistic concepts; 3) Use strategies and procedures to collect and process data; 4) Support conclusions or decisions based on information obtained. Although working with statistical tables is implicit in each of these skills, this is only made explicit in the second of them, where students must “read, describe and interpret statistical information contained in graphs or tables from different sources” (MINEDU, 2016, p. 141).

These new curricular guidelines emphasize that teaching mathematics in general, and statistics in particular, must be focused on the use of significant situations and of interest to students, which evoke previous knowledge and with activities of gradual complexity. Cooperative learning and work should be promoted with the use of different teaching methodologies: Problem-based learning, project-based learning, case studies, among others.

Given this latest curriculum modification, it is of interest to analyze its implementation in textbooks, because this resource is fundamental in teaching and learning processes despite technological development (Braga & Belver, 2016), influencing educational practices of teachers (Olsher & Even, 2014). This pedagogical resource is an example of the curriculum potentially taught in the classroom (Valverde, Bianchi, Wolfe, Schmidt y Houang, 2002), as a result of a didactic transposition (Chevallard, 1991), in which the teacher must be an epistemic guard to avoid biases are transmitted to students (Ortiz, 2002). In addition, there is a direct relationship between curricular guidelines and the textbook (Herbel, 2007; Shield, & Dole, 2013), because the latter directly influences the success or failure of their implementation (Cantoral et al., 2015). Díaz-Levicoy, Giacomone et al. (2017) highlight the usefulness of the textbook for teachers in the organization and development of teaching and learning processes; it is also useful for the students themselves, because they can consult it at any time to clarify doubts and it is in line – or so it should be – with their cognitive development; and in the case of families, it allows them to monitor the learning process of their children and clarify doubts to support the educational process.

In accordance with these considerations, the objective of this study is to analyze the activities on statistical tables in mathematics textbooks for Primary Education in Peru.

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1.1. Statistical tables

Statistical tables are considered an example of transnumeration (Wild & Pfannkuch, 1999), in which new information must be obtained when changing the representation system, for example, when moving from data (not grouped) to a statistical table. For Gabucio et al. (2010) statistical tables are “one of the specific ways of recording and organizing cognitively useful information for a multiplicity of uses” (p. 184). Estrella (2014) defines it as:

> (…) A rectangular arrangement with a structure that comprises a set of rows and columns […], allows to present the data corresponding to one or more variables (characteristics of the phenomenon under study) in a classified and summarized way, in order to display the behavior of the data and facilitate the understanding of the information that can be extracted (p. 6).

Some elements that a statistical table contains are: 1) The Title (informs about variables and contexts represented); 2) The Body (group of cells in which information or data is recorded); 3) Lateral Heading (first column in which categories of the variable are detailed); 4) Top Heading (specifies column content below); 5) Totals (row or column showing the sum of values of the respective cells (Estrella, 2014).
On the other hand, authors such as Cazorla et al. (2017), Díaz-Levicoy, Morales et al. (2020), and Lahanier-Reuter (2003) describe statistical tables used in Primary Education: 1) Data table: Simple representation, only containing data, in which the ideas of variable and value are used, but the ideas of frequency or distribution are not used; 2) Tally table: Simplified version of a frequency table, in which counts are made by means of marks or symbols within the same cell; 3) Frequency table: Representation containing frequencies (obtained by grouping or counting the same data) of values or categories of the variables; 4) Two-way table (or contingency table): Table in which two or more variables are related at the same time.

1.2. Reading levels and semiotic complexity of statistical tables

Curcio et al. (Curcio, 1987; Friel et al., 2001; Shaughnessy et al., 1996) propose a taxonomy of reading levels with respect to statistical graphs. This taxonomy has been widely used in textbook analysis (Díaz-Levicoy, Batanero et al., 2016; Díaz-Levicoy et al., 2018; Díaz-Levicoy, Giacomone et al., 2017; Jiménez-Castro et al., 2020) and adapted for the analysis of statistical tables, as shown in other works on these representations in textbooks (Díaz-Levicoy et al., 2015; García-García et al., 2019). The reading levels are:

- *Level 1. Reading the data*. Literal reading of the information represented in the table.
- *Level 2. Reading within the data*. When a value is obtained through comparisons or simple arithmetic operations with data displayed in the statistical table.
- *Level 3. Reading beyond the data.* It is possible to obtain a value that is not explicit in the statistical table, and that is obtained through interpolation or extrapolation.
- *Level 4. Reading behind the data*. The way of collecting the data, the conclusions highlighted by others, the way of organizing the data, among others, is critically valued.

Similarly, Arteaga et al. (Arteaga, 2011; Batanero et al., 2010) propose four levels of semiotic complexity for the construction of statistical tables and graphs, but they can be easily extrapolated to statistical tables:

- *Level 1. Representation of individual data*. Table in which the ideas of variable or distribution are not used, where isolated data, a piece of data or a portion of them are recorded, without calculating the frequencies when appropriate.
- *Level 2. Representation of a data set, without summarizing its distribution*. Table in which all the data are recorded, one by one, without calculating the frequencies when necessary.
- *Level 3. Representation of a data distribution*. Table in which the frequencies are recorded, prior to the grouping of the same data, working on the ideas of frequency and distribution.
- *Level 4. Representation of several distributions in the same table.* When the frequencies of two or more variables are recorded in the same statistical table.

1.3. Background

Studies that analyze mathematics textbooks are extensive; however, researches that perform statistical content analysis are considerably less (Batanero et al., 2015). As a result of these studies, they have become

lines of research in Mathematics Education (Gómez, 2011) and Statistical Education (Díaz-Levicoy, Giacomone, et al., 2016).
Regarding the analysis of statistical tables in textbooks, literature shows an increase in recent years, but they are still scarce in the Peruvian context. This is reported by Vidal-Henry et al. (2021), who reviewed literature on statistical tables and graphs in Ibero-America, identifying only three researches on statistical graphs in Primary Education textbooks in Peru (Díaz-Levicoy et al., 2018; Díaz-Levicoy et al., 2019). In this sense, Díaz-Levicoy et al. (2018) analyze the types of graphs, as well as the tasks, reading level and semiotic level associated with them. Their results show predominance of bar graphs, calculating and constructing tasks, basic reading levels, and the semiotic level of representation of a data distribution.
Regarding statistical tables, Amorim and Silva (2016) analyze fourth and fifth grade textbooks of Primary Education in Brazil, showing confusion with the use of the word table, the majority presence of charts and data banks, with predominance of the interpreting activity/skill. For their part, Evangelista and Guimarães (2017) study activities on tables in textbooks from first to third grade of Primary Education. The results show predominance of the table as a type of representation, and the skills of completing the table and interpreting data from the table.
In Chile, Díaz-Levicoy et al (2015) analyze activities on statistical tables in first and second grade textbooks of Primary Education. This study reports that tally tables; calculating, completing and translating tasks; the level of reading within the data and the personal context are mostly used. Then, Díaz-Levicoy, Ruz et al. (2017) carry out an analysis of activities with statistical tables in third grade textbooks of Primary Education, showing predominance of tally tables and tasks of translating, calculating and explaining.
More recently, Pallauta et al. (2020) analyze primary mathematical objects on statistical tables in textbooks for grades 5 to 8 of Primary Education. The results show predominance of distribution tables associated with semiotic complexity level 3 (representation of a data distribution). In the field of problems, they observe activities such as table construction, translating (changing from one representation to another), among others. The verbal, symbolic, numerical and diagrammatic stand out. As arguments is the use of examples or counterexamples, use of graphical representations, deductive verbal and deductive algebraic arguments. Regarding procedures, it should be noted that they are related to the reading and construction of tables.
Another study is that carried out by Bustamante-Valdés et al. (2021), who analyze activities on statistical tables in Chilean mathematics textbooks for rural schools. Their results show predominance of tally tables, reading level 2 (reading within the data), semiotic complexity level 3 (representation of a data distribution), the task of calculating, and the personal context.
In Mexico, García-García et al. (2019) analyze activities on statistical tables in Primary Education textbooks (first to sixth grades). The results show predominance of data tables, reading level 2, semiotic level 2, the task of calculating, and the personal context. Finally, in Venezuela, Salcedo (2020) analyzed table activities in primary and secondary education textbooks. He found that semiotic level 3 predominates in primary school, while semiotic level 4 predominates in secondary school.

2. Methodology

To fulfill our research objective, we use a qualitative methodology of descriptive level. For data analysis, the content analysis technique was used (Bernete, 2014). The sample is of an intentional type and consisted of a complete series of mathematics textbooks for Primary Education in Peru (first to sixth grades), which MINEDU distributes free of charge to public educational centers in the country, so they have great national coverage. In each textbook, sections in which some type of statistical table is involved were identified to define the following units of analysis:

- *Type of table*. Including those mentioned and described in previous research in Primary Education textbooks (Cazorla, Magina, Gitirana and Guimarães, 2017; Díaz-Levicoy, Morales et al., 2020; Lahanier-Reuter, 2003): 1) Data table; 2) Tally table; 3) Frequency table; 4) Two-way table.
- *Type of task*. Tasks that can be observed in an activity are considered, that is, an activity can include one or more tasks, in which case the corresponding number will be taken into account. For this study we have considered those described in previous studies (Díaz-Levicoy et al., 2015; Díaz-Levicoy, Ruz et al., 2017; García-García et al., 2019): 1) Reading; 2) Comparing; 3) Calculating; 4) Constructing; 5) Representing on a graph; 6) Explaining, among others, which are described in the results section.

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- *Reading levels*. Considering those described by Curcio et al. (Curcio, 1987; Friel et al., 2001; Shaughnessy et al., 1996): 1) Reading the data; 2) Reading within the data; 3) Reading beyond the data; 4) Reading behind the data.
- *Levels of semiotic complexity*. Considering those described by Arteaga et al. (Arteaga, 2011; Batanero et al., 2010): 1) Representation of individual data; 2) Representation of a data set, without summarizing its distribution; 3) Representation of a data distribution; 4) Representation of several distributions in the same table.

These units of analysis are illustrated with examples in the results section detailed below. Furthermore, regarding the type of table and task, it is possible to observe more than one category in the same activity; for example, two or more different statistical tables can be included in the same activity, therefore, all representations are taken into account.
For data collection, the instrument was designed, which includes the units of analysis used in the study, which allowed to classify activities with statistical tables identified in the textbooks. Finally, to ensure the objectivity of the analysis, the classification made by each of the authors of this research was compared, considering at least a 75 % correspondence.

3. Results

Table 1 summarizes the activities or sections of textbooks analyzed by grade. The presence of this topic is observed in the six grades of Primary Education, with a similar distribution per grade and with an average of 12.2 activities for each textbook.

Table 1
Frequency (and percentage) of activities analyzed by grade

Grade	Activities
1st	13 (17.8)
2nd	13 (17.8)
3rd	14 (19.2)
4th	11 (15.1)
5th	10 (13.7)
6th	12 (16.4)
Total	73 (100)

The presence of these representations is in accordance with what is mentioned in the Primary Education curriculum, where their work is implicitly related to the skills established by MINEDU (2016).

3.1. Type of statistical tables

Regarding the type of statistical tables, as shown in Table 2, the activities mainly involve three tables; tally tables (32.9 %), data tables (31.5 %) and frequency tables (28.8%), with a slight predominance of the first of these tables. Two-way or contingency tables are sporadically observed in the last two years and in the first year of Primary Education.
In the analysis by grade it is observed that data tables and frequency tables are present at all levels, while tally tables appear mainly in the first years (first to fourth).

Table 2
Percentage of the type of table involved in each activity

Type of Table	1st (n=13)	2nd (n=13)	3rd (n=14)	4th (n=11)	5th (n=10)	6th (n=12)	Total (n=73)
Data	15.4	38.5	35.7	18.2	50	33.3	31.5
Tally	53.8	38.5	28.6	63.6	0	8.3	32.9
Frequency	15.4	23.1	35.7	18.2	40	41.7	28.8
Two-way	15.4	0	0	0	10	16.7	6.8

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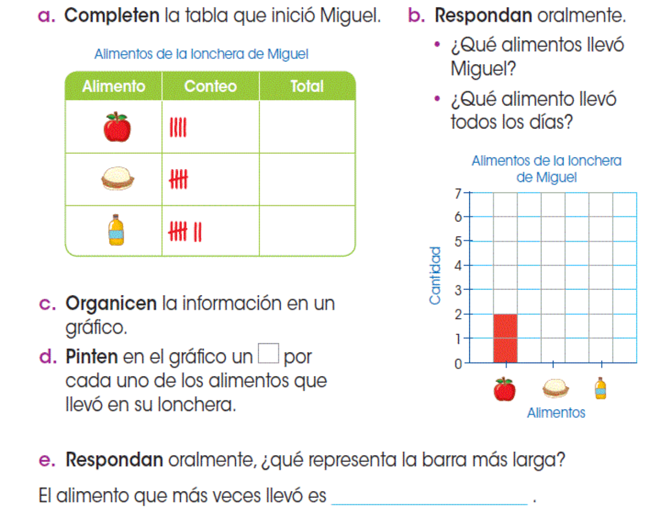
3.2. Type of tasks

This section details the results on statistical tables that are involved in the activities presented in the Primary Education textbooks in Peru.

The tasks identified in this study are described and illustrated with examples below.

Reading. When the student is asked to perform a literal reading of the information presented in the statistical table, that is, it is possible to request the reading of a frequency, the title or a specific category. This task is illustrated with an example in the activity in Figure 1, specifically in the first question in section b., where students must answer what foods Miguel brought and in order to answer this they must read the table and identify the foods shown.



a. Complete the table started by Miguel.
Miguel's Lunchbox
Food – Tally –Total

b. Answer orally.
• What food did Miguel bring?
• What food did he take every day?

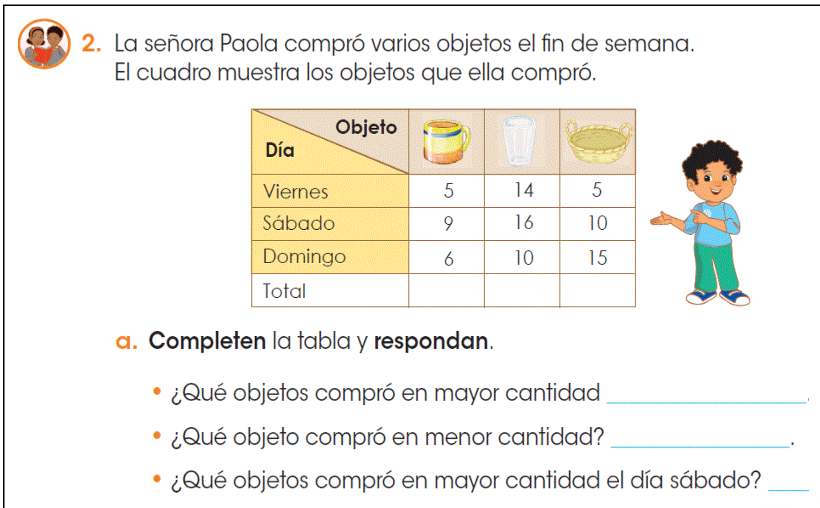
c. Organize the information in a graph.

d. On the chart, paint a box for each of the foods that Miguel brought in his lunchbox.

e. Answer orally, what does the longest bar represent? The food that Miguel brought the most is___________________.

Figure 1. Reading task example (T1, p. 61)

Comparing. When it is requested to establish some order between the data or the information shown in the table, for example, identify the maximum or minimum values, find those greater or less than, among others. In Figure 2, it is asked to identify which objects were bought in greater and lesser quantity, in addition, it is must be indicated which is the product that was bought the most on Saturday. So the students have to compare between total quantities of objects bought at the general level and on Saturday.



Mrs. Paola bought several objects over the weekend. The chart shows the objects that she bought.

a. Complete the table and answer.
• What objects did she buy in greater quantity?
• What object did she buy in less quantity?
• What objects did she buy in greater quantity on Saturday?

Figure 2. Comparing task example (T1, p. 90)

Calculating. When the student must perform an arithmetic operation with the data or information represented in the statistical table, for example, in Figure 3, it is asked to calculate the average time that Paola achieved in her swimming tests, to know if she manages to keep it in 15 seconds. So the students have to calculate that average by adding the time of each test and dividing it by the amount of these.

El papá de Paola le ayuda a calcular su tiempo promedio en sus pruebas de natación. Ella quiere mantenerlo en 15 segundos. ¿Lo habrá logrado?

Prueba 1	Prueba 2	Prueba 3	Prueba 4	Prueba 5
14 s	16 s	14 s	17 s	14 s

a. **Calcula** el tiempo promedio de Paola.

• Paola ______________

Paola's father helps her calculate her average time in her swimming tests. She wants to keep it in 15 seconds. Will she have made it?

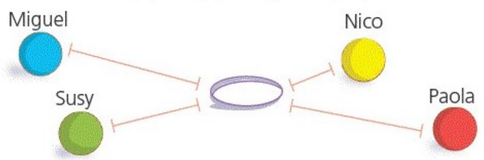
Test 1 – Test 2 – Test 3 – Test 4 – Test 5
14 s – 16 s – 14 s – 17 s – 14 s

a. Calculate Paola's average time.

Figure 3. Calculating task example (T5, p. 82)

Completing. When it is requested to finish the construction of a statistical table with a given structure and with the data provided in the statement (ungrouped data, grouped in a statistical graph or in a table). An example of this task is shown in Figure 4, where it is requested to complete the table according to the distance measurement of the marbles in the hole shown. So the children have to complete the table with the distance measurements of each marble with respect to the hole.

Miguel y sus amigos jugaron a lanzar canicas. Gana el juego quien arroje la canica más cerca de un agujero. ¿Quién ganó el juego? mide las distancias.



a. **Mide** las distancias y **completa** la tabla.

Estudiante	Miguel	Susy	Nico	Paola
Medida				

• Ganó el juego ______________.

Miguel and his friends played throwing marbles. Whoever throws the marble closest to a hole wins the game. Who won the game? Measure the distances.
a. Measure the distances and complete the table.
Student/Measure

a. The winner was ___________.

Figure 4. Completing task example (T3, p. 82)

Representing on a graph. The construction of a statistical graph is requested from the information displayed in a statistical table. In Figure 5, from the data given in the frequency table, the student has to finish a bar graph (following the example given in the graph).

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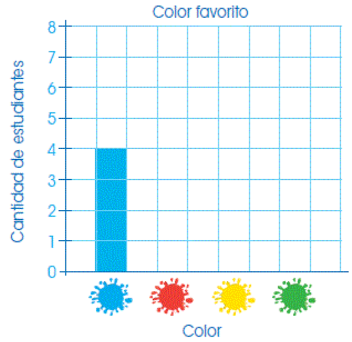
Miguel realizó una encuesta entre sus compañeros para conocer cuál es el color favorito de su salón. ¿Qué color resultó ser el favorito?

a. **Lee** la tabla con las respuestas que le dieron y **pinta** los resultados en el gráfico.

Color favorito

Color	Cantidad de respuestas
	4
	8
	2
	6



Miguel conducted a survey among his classmates to find out what is the favorite color in his classroom. What color turned out to be the favorite?

a. Read the table with the answers given to Miguel and paint the results on the graph.

Figure 5. Representing on a graph task example (T1, p. 116)

Explaining. Task in which the student must argue, detail procedures, give points of view or draw conclusions from the information represented in the statistical table. In Figure 6, in question number five of item a, students have to explain what they can do to find out which grade has more and less chairs. For this, the student must mention the procedure or steps to follow to see the grade in which there are more or less chairs.

En la escuela se realizó el inventario de sillas. Se publicó una tabla para dar a conocer los resultados. ¿Qué grado tiene más cantidad de sillas? ¿Y cuál tiene menos?

a. **Observen** la tabla y **respondan**.

- ¿Cuántas sillas hay en 1.er grado? ________.
- ¿Cuántas sillas hay en 4.° grado? ________.
- ¿En qué grado hay más sillas, en 2.° o en 5.°? ________________.
- ¿En qué grado hay menos sillas, en 3.er o en 6.°? ________________.
- ¿Qué pueden hacer para conocer qué grado tiene más sillas y cuál tiene menos? ________________________.

Grado	Cantidad de sillas
1.er	250
2.°	305
3.er	260
4.°	284
5.°	294
6.°	316

An inventory of chairs was carried out at the school. A table was published to show the results. What grade has the most number of chairs? And which grade has the least number of chairs?

a. Look at the table and answer.

- How many chairs are there in 1st grade?
- How many chairs are there in 4th grade?
- In what grade are there more chairs, in 2nd or 5th?
- In what grade are there more chairs, in 3rd or 6th?
- What can you do to find out which grade has more chairs and which has fewer chairs?

Figure 6. Explaining task example (T3, p.29)

Problem posing. It involves creating a situation in which the data presented in the statistical table keep sense and coherence, as well as the formulation of questions that can be answered from them. An example of this task is shown in Figure 7, where students have to pose a problem, according to the information on types of race.

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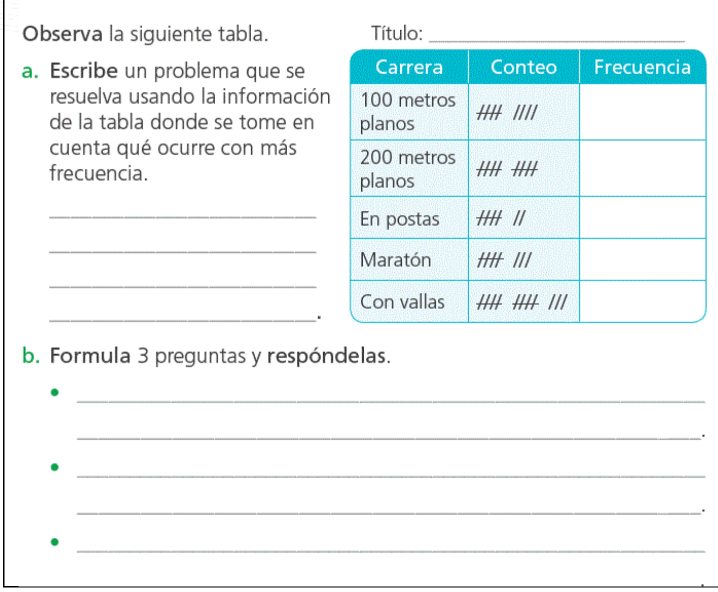

Observa la siguiente tabla.

a. Escribe un problema que se resuelva usando la información de la tabla donde se tome en cuenta qué ocurre con más frecuencia.

Título: ______

Carrera	Conteo	Frecuencia
100 metros planos	~~////~~ ////	
200 metros planos	~~////~~ ~~////~~	
En postas	~~////~~ //	
Maratón	~~////~~ ///	
Con vallas	~~////~~ ~~////~~ ///	

b. Formula 3 preguntas y respóndelas.

Look at the following table.

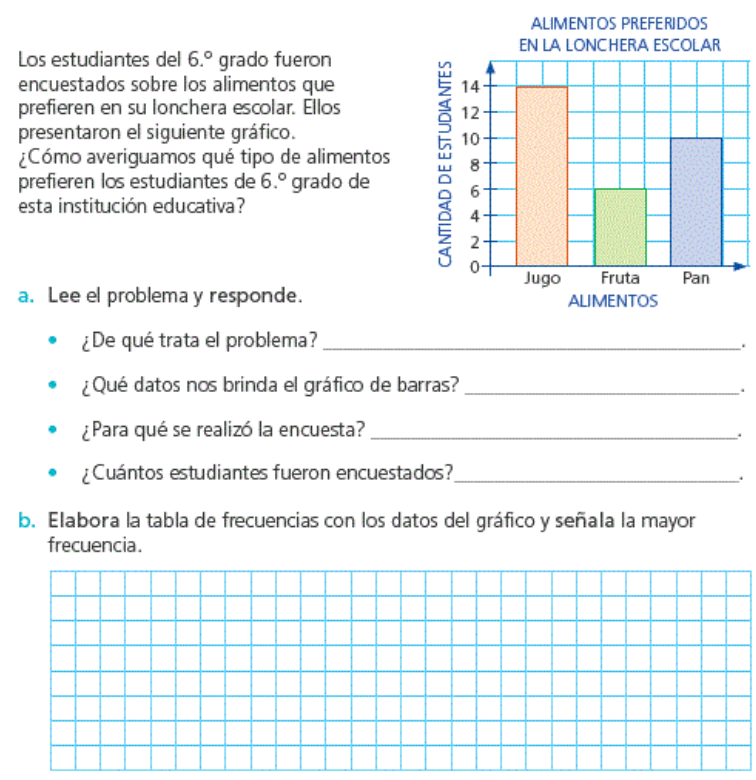
a. Write a problem to be solved using the information in the table where what happens most frequently is taken into account.

b. Pose 3 questions and answer them.

Figure 7. Problem posing task example (T4, p. 138)

Question posing. Students must identify or create the question that allows to obtain some information that has been represented in the table, as well as possible questions that could be answered with the information from the statistical table. For example, Figure 7 shows this type of task. Students have to pose questions from a table.

Constructing. A table must be developed with the information provided in the statement and the student must define its structure. In Figure 8, students have to create a frequency table from a bar graph with the following variables: food and number of students.



Sixth grade students were surveyed about the foods they prefer in their school lunchbox. They presented the following graph. How do we find out what kind of food sixth graders at this school prefer?

a. Read the problem and answer.
- What is the problem about?
- What data does the bar graph give us?
- What was the survey done for?
- How many students were surveyed?

b. Create the frequency table with the data from the graph and indicate the highest frequency.

Figure 8. Constructing task example (T6, p. 106)

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Table 3 shows task distribution on statistical tables identified in the textbooks of Primary Education in Peru. In it, it is observed that the most frequent tasks are to complete (79.5 %), compare (46.7 %) and explain (34.2 %), the first two present in the six grades of Primary Education. The tasks related to problem posing (1.4 %) and question posing (1.4 %) are observed sporadically.

Table 3

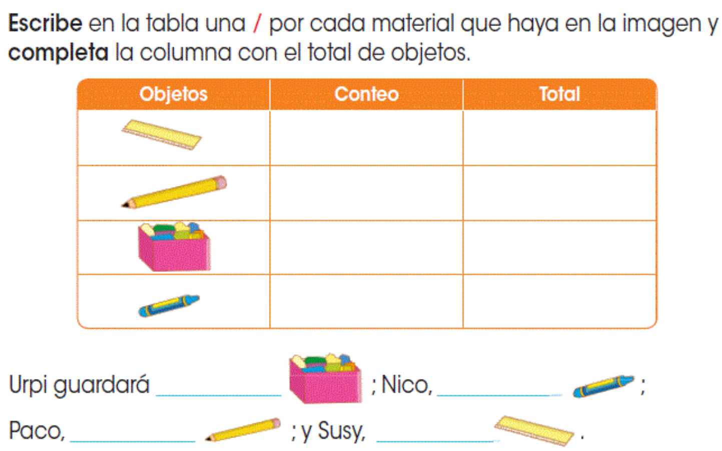
Percentage of the type of tasks related to statistical tables in textbooks

Type of Table	1st (n=13)	2nd (n=13)	3rd (n=14)	4th (n=11)	5th (n=10)	6th (n=12)	Total (n=73)
Reading	15.4	38.5	7.1	36.4	10	16.7	20.5
Comparing	61.5	46.2	42.9	54.5	30	41.7	46.7
Calculating	23.1	15.4	21.4	9.1	50	50	27.4
Completing	92.3	100	71.4	81.8	70	58.3	79.5
Representing on a graph	46.2	30.8	21.4	45.5	40	25	32.9
Explaining	0	7.7	71.4	36.4	30	58.3	34.2
Problem posing	0	0	0	9.09	0	0	1.4
Question posing	0	0	0	9.09	0	0	1.4
Constructing	0	0	0	0	10	25	5.5

3.3. Reading levels

This section describes the results regarding reading levels described by Curcio et al. (Curcio, 1987; Friel et al., 2001; Shaughnessy et al., 1996) identified in the activities on statistical tables in Primary Education textbooks.

Figure 9 shows reading level 1 (data reading), where the students have to perform a literal reading of the information given in the table, which consists of identifying the total number of objects that will be put away by type.



Draw a / in the table for each material in the image and complete the column with the total number of objects.

Urpi will put away ____________; Nico ________________; Paco ____________; and Susy ___________.

Figure 9. Reading level 1 example (T1, p. 29)

Reading level 2 (reading within the data) is illustrated with an example in Figure 3, where students have to read the values given in the data table and perform a simple calculation to answer if Paola met the time of swimming she wanted to achieve. For this the students have to calculate the average, mean or arithmetic mean.

Reading level 4 (read behind the data) is illustrated with an example in Figure 10, in which a situation of an election in a school council is detailed, and the students have to relate the information given in the table with the context, arguing whether or not there will be a runoff election, according to the number of votes.

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En la I. E. 1040, se llevaron a cabo las elecciones del Municipio Escolar. La lista ganadora deberá tener una diferencia de 10 votos, como mínimo, sobre la lista que quede segunda, porque, de lo contrario, habrá una segunda vuelta electoral.

Elecciones del Municipio Escolar

Lista de candidatos	Conteo	Cantidad de votos
Vamos Juntos	卌 卌 卌 卌 卌 卌 卌 卌 卌	
Todos Unidos	卌 卌 卌 卌 卌 卌 卌 卌	
Viva la I. E. 1040	卌 卌 卌 卌 卌 卌 卌 卌 卌 卌	
Somos Ganadores	卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌	

a. **Cuenten** los votos y **completen** la tabla.

b. **Respondan**.

- ¿Qué lista obtuvo más votos? ________________________.
- ¿Qué lista obtuvo el segundo lugar? ____________________.
- ¿Habrá segunda vuelta electoral? ______________________.
  ¿Por qué? ___________________________________

In the Educational Institution 1040 the elections of the School Council took place. The winning list must have a difference of at least 10 votes over the list that is in second place, because, otherwise, a runoff election will take place.

a. Count the votes and complete the table.

b. Answer.
- Which list got the most votes?
- Which list got second place?
- Will there be a runoff election? Why?

Figure 10. Reading level 4 example (T1, p. 29)

Table 4 shows the distribution of the reading level observed in each activity involving statistical tables. It shows the predominance, at a general level and by grade, of reading level 2 (reading within the data) related to the application of algorithmic processes with the data or information observed in the table. It is followed by level 1 (data reading) (13.7 %), also present in all the grades analyzed. On the other hand, reading level 4 (reading behind the data) is observed only in the third and sixth grade textbooks of Primary Education.

Table 4

Percentage of reading level by grade

Reading Level	1st (n=13)	2nd (n=13)	3rd (n=14)	4th (n=11)	5th (n=10)	6th (n=12)	Total (n=73)
1	15.4	15.4	7.1	18.2	10	16,.7	13.7
2	84.6	84.6	85.7	81.8	90	75	83.6
4	0	0	7.1	0	0	8.3	2.7

3.4. Levels of semiotic complexity

Finally, this section describes the results regarding the levels of semiotic complexity described by Arteaga et al. (Arteaga, 2011; Batanero et al., 2010) in the activities involving statistical tables.

Figure 11 shows an activity involving a statistical table with semiotic complexity level 2 (representation of a data set, without actually summarizing its distribution). The activity consists of measuring the objects indicated in the table and recording the measurements of length, width and total length of the edge (in cm), so the idea of frequency or frequency distribution is not used.

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Se van a decorar algunos objetos del aula colocando cintas de colores en sus bordes.

a. **Midan** los objetos que se indican en la tabla con la cinta métrica que se encuentra en la siguiente página y **complétenla.**

Dimensiones / Objetos	Largo en centímetros (cm)	Ancho en centímetros (cm)	Longitud total del contorno (cm)
Carpeta			
Pizarra			

b. **Respondan.**

- ¿Qué objeto tiene mayor longitud en su contorno?_______________.
- ¿Qué hicieron para saberlo? ___________________________________

Some classroom objects will be decorated by placing colored ribbons on their edges.

a. Measure the objects listed in the table with the measuring tape on the next page and complete the table.

b. Answer.
- Which object has the longest edge?
- What did you do to find out?

Figure 11. Level of semiotic complexity 2 (T3, p. 82)

Figure 5 shows an activity involving a statistical table where a data distribution is represented (level of semiotic complexity 3), since the frequencies of the colors preferred by Miguel's classmates are recorded.
Figure 2 shows an activity involving a two-way table, which is related to a level of semiotic complexity 4 (representation of several distributions on the same table). This table represents objects bought on a weekend, and students must compare the number of objects bought according to the questions asked.
Table 5 summarizes the distribution of activities according to the level of semiotic complexity of the statistical table and grade. It shows the predominance of level 3 (representation of a data distribution) (60.3 %), both at a general level and in the first, second, fourth and sixth grades of Primary Education. It is followed by semiotic level 2 (representation of a set of data, without summarizing its distribution) (32.9 %) and semiotic level 4 (representation of several distributions in the same table). This last semiotic level appears sporadically and not continuously, in the first and last two years of Primary Education.

Table 5

Percentage of level of semiotic complexity by grade

Reading Level	1st (n=13)	2nd (n=13)	3rd (n=14)	4th (n=11)	5th (n=10)	6th (n=12)	Total (n=73)
2	15.4	30.8	50	18.2	50	33.3	32.9
3	69.2	69.2	50	81.8	40	50	60.3
4	15.4	0	0	0	10	16.7	6.8

4. Discussion and conclusion

Analyzing the presence of mathematical and statistical content in textbooks is a way of approaching what is taught in the classroom, given the relevance and use of these pedagogical resources by teachers, students and families.
This research sought to analyze activities involving statistical tables in Primary Education textbooks in Peru, which are published by the Ministry of Education of Peru, considering four units of analysis: Types of tables, types of tasks, reading levels and levels of semiotic complexity; used in previous research.
Regarding the type of tables, tally tables are the most recurrent in Primary Education textbooks in Peru (32.9%). These results are consistent with those of Díaz-Levicoy et al. (2015), Díaz-Levicoy, Ruz et al. (2017), and Bustamante-Valdés et al. (2021). This type of table is proposed for teaching prior to frequency tables, so they are recommended to be included in the first years of Primary Education.
Regarding the types of task, the completing task is the one that predominates in the analyzed textbooks, with a presence in 79.5 % of the activities. This result is consistent with previous research where this task is among the three most frequent (Bustamante-Valdés et al., 2021; Díaz-Levicoy et al., 2015; García-García et al., 2019).

The less frequent tasks are those of posing problems and posing questions, the latter is only observed sporadically in the work of Díaz-Levicoy et al. (2015). On the other hand, the task of posing a problem has been found in the study by Díaz Levicoy, Batanero et al. (2016) on statistical graphs in textbooks from Chile and Spain.

Regarding reading levels, level 2 (reading within the data) is the one that appears most frequently (83.6%), which is associated with the development of calculations or comparisons, while reading level 4 (read behind the data) is absent in four of the six grades. The predominance of level 2 is consistent with the results of previous research (Díaz-Levicoy et al., 2015; Díaz-Levicoy, Ruz et al., 2017; Bustamante-Valdés et al., 2021). The high prevalence of this reading level motivates teachers and researchers to inquire about the purpose of proposing these activities to students, so as not to reduce statistical work to the calculation of values.

Regarding levels of semiotic complexity, the predominance of level 3 (representation of a data distribution) (60.3 %) is observed, which is consistent with the results obtained by Bustamante-Valdés et al. (2021) and Pallauta et al. (2020).

It should be noted that these results are novel in the Peruvian context, since they provide background for reflection on the educational process, in order to ensure that Primary Education students develop skills related to statistical culture through work with statistical tables, and addressing aspects of competence 4 (solving data management problems and uncertainty). But, for this, it is necessary that a greater number of activities and a variety of tasks (for example, constructing, problem posing or question posing) be delivered on statistical tables, strengthening the work with contingency or two-way tables in the last levels of Education Primary. In addition, it is suggested to give greater presence to level 4 of reading and semiotic complexity, which are sporadically observed in the activities on statistical tables in the analyzed textbooks.

In addition, this research provides information of interest for the training of Primary Education teachers, who must have didactic-mathematical knowledge to teach statistical tables. This, mainly, because the presence of this knowledge in the Primary Education curriculum "does not ensure its teaching; that is, it is possible that this only remains on paper" (Advíncula & Osorio, 2016, p. 1056). In addition, various researches from Peru and other nations reveal the little training of teachers on statistics (Advíncula & Osorio, 2016).

Finally, as a future projection, it is necessary to expand the sample of textbooks, consider other educational levels, such as Secondary Education, and rely on other theoretical elements. In addition, it is of interest to inquire about the evaluative activities that teachers carry out on this knowledge in Primary Education.

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