Original article

Double-entry tables to activate knowledge in the teaching-learning process in elementary school students

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ABSTRACT

The use of double-entry tables facilitates various processes, surpassing their most common use, the presentation of research results. This versatility allows its incursion in the development of teaching-learning in the classroom as a support for teachers and students since it helps to organize, systematize, and order the information of two variables. This reality led to an analysis of its advantages based on a bibliographic review, the results of which allow us to recommend its incorporation into school activities in elementary education, given the opportunity it provides to construct meanings and contribute to the achievement of significant learning.

Keywords: Double-entry tables; Knowledge; Teaching-learning process; Elementary education.

Introduction

Currently, the world is going through great challenges due to the context generated by the COVID-19 health emergency, which place education before great challenges, causing our behaviors to change from one day to the next without any type of planning (Muñoz, 2020). It is a context where some students continue learning and others do not,

due to the lack of physical and technological infrastructure in their homes (Mateo, 2020).

In view of this, the educational crisis and the need to implement differentiated actions and forms of teaching with relevant strategies that generate learning conditions that include useful tools that provide meaning.

In this sense, it is considered useful to implement double-entry table strategies in the classroom, which have been regularly used to issue conclusions and report research results (Martínez, Andagoya & Fuertes, 2020). But they can also be taken to the classroom setting, given that in a double-entry table the processes can be presented, thus developing a comprehensive weekly session through ICT and student learning.

They can also be used for the analysis of historical facts, as Canales, Urrutia and Escudero (2019), who explain the colonial context of the Mapuche people based on the material conditions between colonizer and colonized.

Likewise, it can be applied in the reading comprehension of English texts, having favorable results in learning through the contribution of security that it allows to give students (Muñoz and Quito, 2021). Considering these aspects, a study was developed with the objective of analyzing the advantages of its application, for which a bibliographic review was carried out to provide pertinent information to recommend its incorporation in school activities in primary education where it is not yet being used as provided in the educational policies of various Latin American countries.

Development

The importance and benefit of the application of double-entry strategies is based on the fact that they constitute a response to the need to organize, systematize and order information (Rupérez and García, 2018). Their use allows taking a look at two variables at the same time, one in rows and the other in columns, concentrating in the same point all the common information, facilitating having classified information. As well as providing opportunities for students through the construction of meanings, which facilitates the achievement of greater significance of the learning and encourage systematization while they are also taught to build them and read their content.

In this way, the double-entry table can play a strategic role in activating knowledge during the teaching-learning process in elementary school students. This function offers a great advantage, because it propitiates in them the organization and systematization of information in order to summarize information and explain the contents in a more secure and well-founded way.

A result that contributes to order the internal mental processes from the perception of the stimulus to the final response (Dorado, Ascuntar, Garces & Obando, 2020).

The theory points out that, through didactic and practical contents, students approach the contents and can develop their competencies, while learning values, cooperation, and teamwork and understanding of their environments. Aspects applicable to all subjects contained in the training programs (Vásquez-Cano, E., 2021). In this regard, it should be noted that the school curriculum comprises different degrees of concreteness, through which the functioning of the educational process and the school system of each country is known, reflecting the educational policies of each territory as a response to the type of person and society it hopes to form. The current reality has demonstrated the need for critical, creative, cooperative and competent individuals to read, understand, interpret and analyze data, obtaining meaningful learning, for which skills such as those required for the management of double-entry tables are required (Villalpando, 2022).

According to the theory of cognitive development, cognitive progress occurs in great transformations and the way in which knowledge is organized, due to the fact that it must occur in a process of biological, social and environmental maturation (Piaget, 2019). Students are not less thinkers, since children build their mental model by progressively reorganizing cognitive processes, from comprehension to experimentation (Ruiz-Velasco and Barcenas, 2019).

Likewise, this affirmation is promoted by Ovide Decroly's three phases, i.e., observation, association and expression, which enclose learning and make up the fabric of mental activity (Hernández, 2019).

This double-entry table strategy can also be applied in vocabulary learning, from the texts, with the extraction of names, word recognition, categorization and characteristics. In this way, for example, it can encourage the use of English language classes with favorable results while promoting student confidence if it is used as a technical resource to optimize learning (Muñoz and Quito, 2021).

For this reason, it is often pointed out that the use of some techniques, such as these referred to as double-entry tables, should be incorporated into the teaching process,

making them part of the training, since they provide valuable information for students' learning.

This incorporation must be accompanied by the teacher's knowledge, reading and interpretation domain since, otherwise, if there is no mediating guide, this process can give unfavorable results (Gea, Gossa, Batanero and Díaz-Pallauta, 2020), which can lead to not obtaining learning achievements and getting only reproductive, superficial and without any significance results (Sepúlveda, Díaz-Levicoy and Jara, 2018).

As expressed by the Ministry of Education of Peru (MINEDU) (2016), the relevance and effectiveness of the strategy has much to do with the orientation in the teaching and learning process, thus guiding the organization and systematization (Rupérez & García, 2018) of information, given that this whole process leads to the development of internal mental processes (Sepúlveda et al., 2018). This type of orientation allows having clear ideas that serve to issue conclusions, which are the result of mental processes generating analysis and closures from interpretations of tables and graphs.

Hence the importance of the application of double-entry tables in the student's training process, since it facilitates visualizing from what the student perceives to the answer reached by him (Dorado et al., 2020). That importance is broad, lies in that it can be used in different processes such as evaluations and measurements of the learning process, such as conceptions, purposes, methodology and results for reflection (Quispe, 2018).

Double-entry tables are related, as previously mentioned, based on two variables, which organize and equate knowledge and can contrast different elements referring to the same topic. They include quantitative, numerical, text and scale data, allowing students to analyze, compare and express their opinions on them.

This type of tables have constituted since many years ago a useful tool in research processes and use of statistics, enabling the organization of data, obtaining and relating information and producing new knowledge and its main feature is that it can accommodate and compare horizontal and vertical information (Ortiz-Colón and Ortega-Tudela, 2018).

In accordance with the above, it is worth considering starting its implementation in primary school grades and even in children under six years of age (Chica, 2020), because it has been shown that it promotes autonomy, favoring work organization, reasoning and understanding. In Latin America, for example, it is observed that its use is infrequent among teachers, and it is estimated that most of them begin to use tables

and graphs in higher grades, despite being aware, in several schools, that double-entry tables contribute significantly to the learning process (Brandi, 2018; Gaete, 2021).

In this sense, it is considered that teachers should be encouraged in the use of tabular language during their classes and teach its usefulness to students as they advance in their education, due to the need to promote in them the management of mathematics and statistics for their future life. By assuming it as a proposal, they will be able to interpret their progress while visualizing their progress during the teaching process, especially because this will allow them to organize their information and encourage interpretation through completion activities, readings and information constructions (Gea et al., 2020).

Similarly, it should be noted that double-entry tables allow drawing conclusions, analyzing groups and their differences, detailing results, emphasizing their value in a practical way, and observing the relationship between work groups, as well as the differences in their interactions and the establishment of meaningful relationships (Curcio, Peralta, & Castellaro, 2019).

Therefore, it is reflected with respect to its insertion in classroom activities, also projecting with this creative proposal for the appreciation of mathematics and statistics throughout primary education, since it can contribute in the student development of cooperative activities, with counting tables that translate and calculate through graphs and arithmetic operations (Cervantes, 2019).

The management of data and uncertainty about topics of interest should be propitiated to develop reasonable predictions and solutions supported by statistical data and tested with interpretation to communicate them (Ruiz-Velasco and Barcenas, 2019).

This can also be accompanied by a graphic test that allows evaluating the possible explanations of the expressed data, which will help to have a better expression of presentation and understanding of some daily facts that they will be in the possibility of capturing from another perspective.

Taking up some regional experiences, Bustamante-Valdés, Díaz-Levicoy and Pardo-Cañete (2021) express having observed that in the mathematics books that the Chilean Ministry of Education delivers to rural institutions, counting tables and frequency tables predominate, which are usual in traditional primary school textbooks aimed at the first and second levels of basic education.

Theoretical foundations linked to reading and complexity are considered in them, adding that in fifth to eighth grades students can read data and perform data distributions; however, it was detected that in the sixth level of primary education there

is no work with statistical tables, which are not included in the learning objectives either, differing from the content of other traditional teaching materials in the country.

According to these researchers, no activities are revealed that go beyond reading data, inferring that students are not required to make predictions based on the data shown in the statistical tables, coinciding with the contributions of Bustamante-Valdés et al., 2021).

On the other hand, Díaz-Levicoy, Morales, Arteaga and López-Martín (2020) presented the results of an investigation developed in groups of students in the third year of basic education in municipalized institutions in Chile to determine their knowledge of statistical tables. The instruments designed were based on the content of texts used in previous courses, showing a better performance in the literal reading of data and in the creation of tables with respect to their collection and estimation, which demonstrates the achievement of an elementary mastery. Aspects that are worked on in Mexico since the first grade of primary education, as stated by García-García, Díaz-Levicoy, Vidal-Henry and Arredondo (2019).

As a complement, we reviewed the work of Salcedo (2020), referred to the Venezuelan case, who analyzed the activities proposed in the texts distributed by the Ministry of Popular Power for Education of Venezuela, considering as background that statistical tables were incorporated into primary and secondary education since the late 1980s.

In this sense, he explains that at the primary level, the contents are limited to single-entry tables, with a requirement of integral reading, while those referring to double-entry tables are used in high school, where the readings practiced can be partial and integral. Explaining that, in general, the books considered do not seem to include activities that allow students to reach an adequate understanding of statistics and other activities related to mathematics.

The research on this subject corroborates that it has been an area of interest in the educational field for nearly twenty years, with most of the studies carried out aimed at analyzing the table of frequencies, the second level of reading, the third level of semiotic complexity and the activity of calculating. This tool is contemplated in the content of Ibero-American primary school textbooks in Argentina, Brazil, Chile, Colombia, Costa Rica, Spain, Guatemala, Mexico, Peru and Venezuela (Vidal-Henry, Arredondo and García-García, 2021).

The results coincide in the need for each of these countries to insert activities that allow students to achieve reading levels 3 and 4, that is, to learn the meaning of the data

beyond a literal reading, including information that may be behind them. To this is added the requirement to teach them how to predict and evaluate from a critical sense the information yielded by statistics, as well as the ability to counteract data and communicate them.

Conclusions

Double-entry tables have been defined as graphic tools whose usefulness in the systematic organization of information derived from two variables facilitates comparison and the deduction of conclusions on some aspects of interest. In research processes, they are widely used to present results and show common aspects among the data collected, but their use goes beyond this technical function, showing the advantages they can provide in different spaces, such as those referred to classrooms.

The order in which the information is presented in these tables facilitates the observation and interpretation of data by means of rows and columns, which may refer to qualitative or quantitative aspects. At basic education levels, they facilitate the development of skills related to logical and mathematical reasoning, a learning process that can also be applied to subjects such as history or natural sciences, where this type of resource has been successfully used in the understanding of their contents. Its inclusion in daily classroom activities contributes to fostering students' autonomy and creativity, while stimulating teamwork, coexistence and progress in verbal language. However, the teaching staff must also be encouraged to incorporate it into their academic planning and begin its application in a playful way in the classroom, in addition to the fact that these tables should be contained in the texts distributed for use in the school system.

As a resource or educational support tool, double-entry tables make it possible to present data in an organized way, which simultaneously helps to select relevant information and, gradually, to make decisions according to a context of interest. The documents considered for this research show that the number of activities that include these double-entry tables in the texts used, generally suggested by the respective ministries of education, are insufficient to achieve significant knowledge.

Students must learn to make their own deductions from the data they place in these tables, which allows detecting the need for complementary activities or texts that help them to exercise more in the practice of the knowledge acquired to better understand the importance of their management, while they receive guidance from their teachers.