# Design And Implementation Of An ICT Method To Improve The Teaching Of Fractions In Primary And Secondary School Teachers In Soacha – Colombia

Luis Alexis Plazas Gómez[1], Liliana Orizel Martínez Martínez[2], Fredys Alberto Simanca[3]

[1]Fundación Universitaria los Libertadores, Bogotá – Colombia,
[2]Universidad Autónoma de Ciudad Juárez,
[2]Universidad Cooperativa de Colombia, Bogotá – Colombia,

**Summary**
This article presents the design, implementation and evaluation of an innovative method that integrates Information and Communication Technologies (ICT) to train teachers in the teaching of fractions, aimed at fourth, fifth and sixth grades in official educational institutions in the municipality of Soacha, Cundinamarca, Colombia. The problem arises from the limited training of teachers in the use of ICT tools, which affects pedagogical practices and student learning in mathematics. The research, with a quantitative approach and experimental design, bases its theoretical framework on social constructivism, promoting active and collaborative learning. The results show a significant improvement in teaching practices and in student performance after training, consolidating the relevance of the method and its potential for extension to other curricular areas.
**Keywords:** ICT, fraction teaching, teacher training, pedagogical method, constructivism, mathematics, primary and secondary education.

## INTRODUCTION

The effective use of ICT in education represents a challenge and an opportunity to improve pedagogical practices and learning in mathematics. In the context of the official institutions of Soacha, Cundinamarca, Colombia, a notable deficiency was identified in the training of teachers for the use of these tools, especially in issues of operations with fractions, fundamental in basic mathematical training.

This research seeks to demonstrate how teachers, through the use of ICTs, can improve their academic performance mainly in the classroom, increasing the comprehension capacity of their students and their motivation when using these tools in their learning processes. The project is aimed at training teachers in the use of ICT in the area of mathematics with the topic fractions of the fourth, fifth and sixth grades of two educational institutions in the municipality of Soacha, Colombia, through a method that contains different phases and pedagogical strategies leading to a 180-degree turn in the way some teachers have been teaching their classes. As a fundamental theory in the support of this study, it can be indicated that constructivism was taken as a pedagogical model, to the extent that it is considered that knowledge is developed through the teaching-learning process and the evaluative process, allowing the integration of the student into the reality of his environment, managing to interpret the knowledge acquired. Thus, the constructivist model relates how the training process should allow an exchange of ideas between teachers and students where the former generate actions aimed at enhancing the cognitive development of students seeking to achieve significant learning that can be applied in everyday life.

**Problem Statement and Justification**

The lack of a systematic and practical method to train teachers in the use of ICT in the teaching of mathematics, specifically in fractions, limits the quality of the educational process. The problem is aggravated in the official institutions of Soacha, where traditional methodologies predominate due to the lack of familiarity with digital technologies. The central hypothesis states that, with a method specifically designed to integrate ICT in the teaching of fractions, it will be possible to improve pedagogical practices and student learning. This study is relevant because it responds to the need to modernize teacher training and offer innovative didactic tools, aligned with the demands of the knowledge society. The justification of the research is based on the fact that some teachers in the area of mathematics in the official schools of the municipality of Soacha, Cundinamarca, Colombia, do not have a method to advance the teaching-learning process through the appropriate use of information techniques; therefore, the research is carried out mainly to solve a problem, clearly identified in the municipality of Soacha Cundinamarca Colombia, and seeks that, from the design of a method, pedagogical practices are improved and the educational community benefits from the new educational processes used by teachers and students. The research approach is quantitative, with a type of experimental design , with a type of research of cross-sectional or cross-sectional design and a correlational scope of study. Correlational-casual designs can be limited to establishing relationships between variables without taking into account chance, while in non-casual relationships the foundation revolves around correlational hypotheses, which seek the evaluation of casual links Hernández et al. (2014).

## THEORETICAL FRAMEWORK

The theoretical basis is based on social constructivism, which postulates that knowledge is actively constructed through interaction and collaboration. Authors such as Piaget and Vigotsky emphasize that meaningful learning arises in environments where the student is the protagonist and the teacher acts as a facilitator. (Castillo, 2008). ICT enhances this approach, allowing the creation of dynamic and participatory learning environments. The integration of digital resources such as videos, interactive presentations, online games, software such as Quizizz, and digital booklets, favors the understanding of complex concepts such as fractions, through visual representations and playful activities. Various studies, such as those by Gutiérrez and Torrejo (2018), highlight that training in ICT and digital media is key to transforming pedagogical practices, promoting active and motivating learning.

**Design and Implementation of the Method**

The method developed contemplates various strategies and digital resources. The following is a list of the steps used to design the method of teaching fractional numbers in the fourth, fifth and sixth grades with the help of ICT tools.

**Step 1.**

**Introduction and Conceptualization**

**Introduction to fractions.**

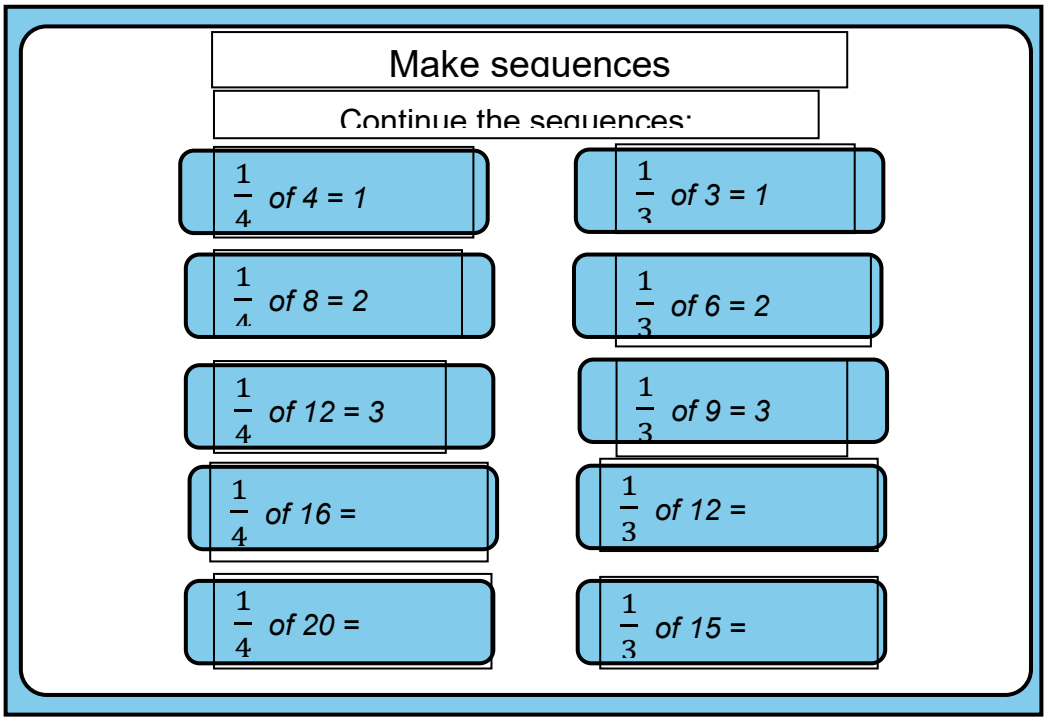
Fractions or fractional numbers are an essential part of arithmetic that describes the parts of a whole. According to (Bayas Yuquilema, 2024), the fraction is a mathematical representation that expresses a part of a whole in terms of a quotient of two whole numbers, where the top number is called the numerator and the bottom number is called the denominator, which allow a quantity to be divided into equal parts and are a way of expressing non-whole or fractional quantities precisely. We can have an example when distributing a pizza among friends. To get into the subject, the teacher can start by

explaining what fractions are, where it is suggested to use an interactive presentation or a short video that shows day-to-day situations where fractions are used. In this part, it is recommended to watch different videos related to the elements of a fraction.
Interactive resources or short videos, as suggested by the modern didactic methodology Estupiñán-Coox et al. (2024), with technological advancement and the availability of digital resources such as Wordwall, an opportunity arises to improve understanding and motivation in the learning of fractions, as it helps students to better visualize and understand how fractions are used in real life. These interactive resources can show practical situations where fractions are applied intuitively, facilitating their understanding and subsequent solution of mathematical problems.

**Defining Key Terms**
It is essential that students master the terms related to fractions, such as:
Numerator: It is the top number of a fraction that indicates how many parts are being considered within a divided whole.
Denominator: It is the bottom number of a fraction that indicates how many equal parts the whole is divided into.
Proper Fraction: A fraction where the numerator is less than the denominator, representing a quantity less than one.
Improper Fraction: A fraction where the numerator is equal to or greater than the denominator, representing an amount equal to or greater than unity.
Mixed Fraction: A combination of an integer and a proper fraction.
To better understand the above concepts, it is recommended to watch short videos on youtube related to proper fractions, improper fractions and mixed fractions.

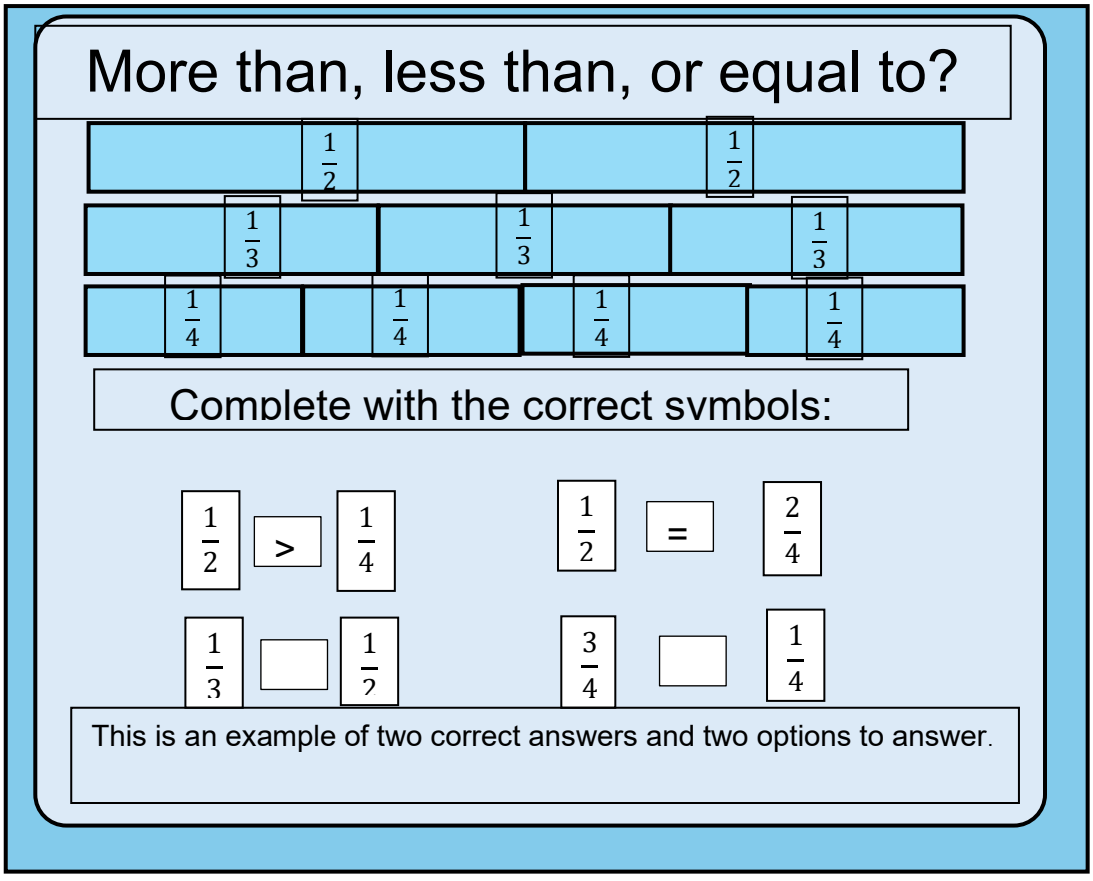
**Step 2.**
**Examples and Guided Practice. Visual examples:**
Digital resources such as interactive whiteboards or drawing apps should be used to show visual examples of fractions. For example, divide simple geometric shapes like circles and rectangles into equal parts to represent fractions. To see some visual examples, you should watch the following short video:
https://www.youtube.com/watch?v=oY0wK5f9wuw
The teacher must elaborate other similar examples on the board, so that the students can give feedback on what they have learned.
**Guided practice**
Step-by-step examples should be provided where students can practice identifying fractions in visual and numerical contexts. Therefore, it is suggested to use interactive software where they can drag and drop fractions or solve simple problems.
As a practical guide, it is recommended to take into account part of the following exercises, listed in the following images:
In Figure 1, the sequence of the results recorded in the first six (6) tables must be followed and the last four tables must be completed with the corresponding equivalence.

Figure 1. Equivalences fractions.



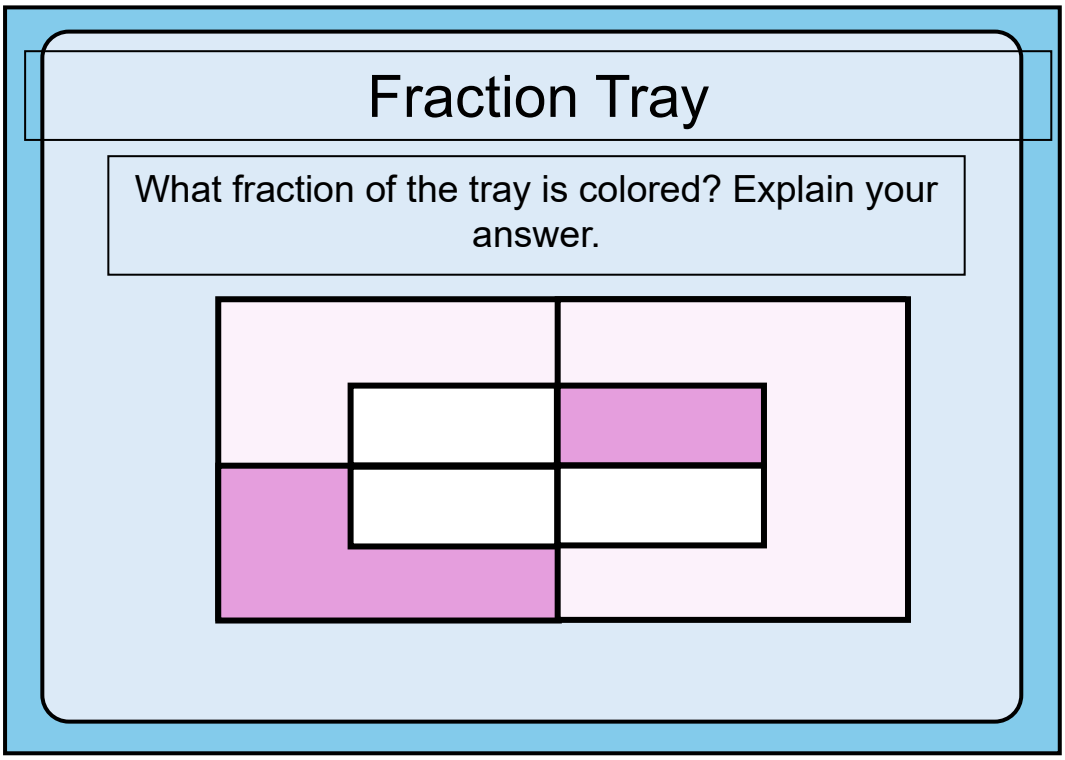

The following figure divides a solid element initially into two equal parts (1/2 each), then the same solid is divided into three equal parts (1/3 each) and finally the solid is divided into four equal parts (1/4 each). The practical exercise consists of comparing fractions using the symbols more than (>), less than (<) or equal to (=), according to the two examples with correct answers.

Figure 2. Compare fractions



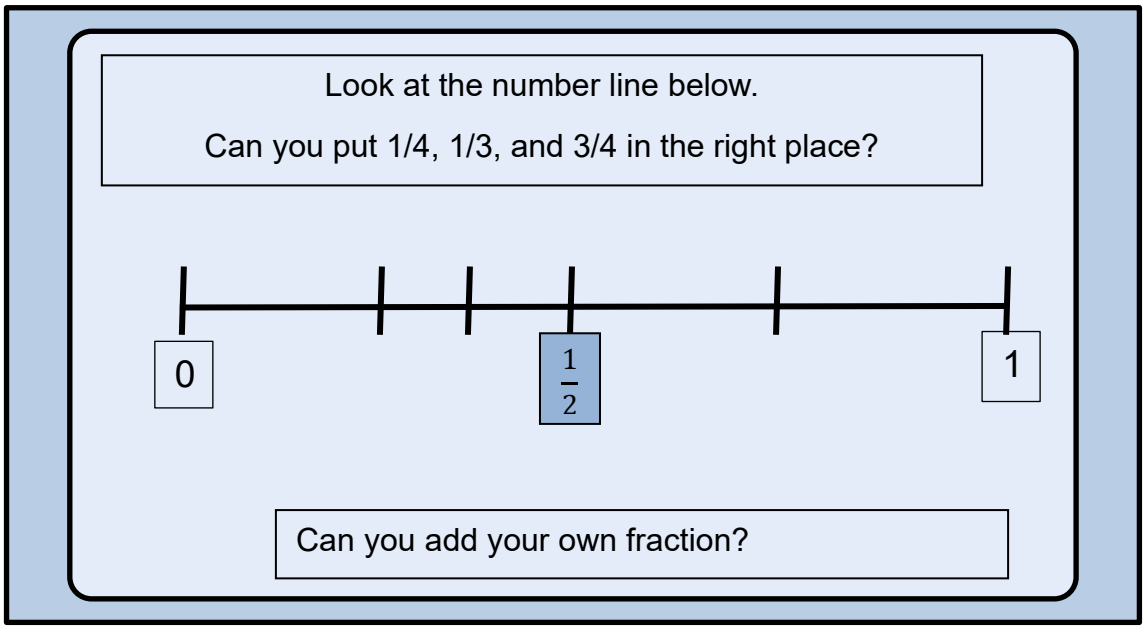
The following example allows you to compare the colored fractions of a tray. The exercise consists of explaining what fraction of the tray is colored?

Figure 3. Fraction tray



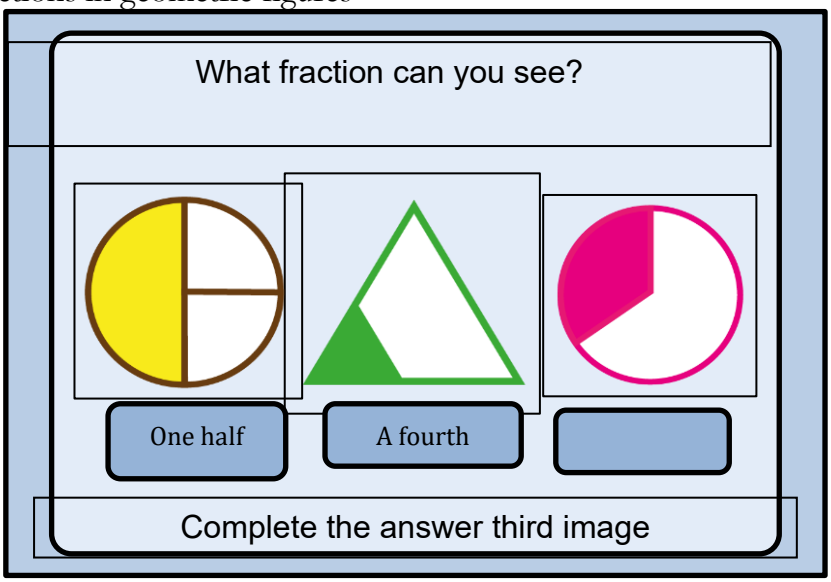

As can be seen in the figure above, 1/4 of the tray is colored. If you move the bottom to the outside side, it would be 1/4 of the entire tray that would be colored.
Fractions can also be represented on the line of real numbers. The following image allows us to divide the line segment that goes from zero (0) to one (1), into fractions such as: halfs, thirds and quarters of a line. The practical exercise consists of observing the fractions placed in the example and placing the fractions 1/4, 1/3 and 3/4 in the correct part.

Figure 4. Fractions on a line



The next practical exercise consists of observing the geometric figures in the example, where it is observed that the colored fraction of the circumference corresponds to half of it, that is, (1/2). As for the triangle, the shaded fraction corresponds to a quarter (1/4). For the third figure, you must write and explain what fraction of the circle is shaded.

Figure 5. Fractions in geometric figures




**Step 3.**

**Practical Activities and Application**

Interactive games.

Using online educational games is a very good strategy for students to develop mathematical skills with fractions in a dynamic and entertaining way. These games allow students to practice basic operations such as addition, subtraction, multiplication, and division with fractions. For example, games that require students to solve fraction problems while playing through interactive scenarios. According to (Aragón Villanuev, 2023), he states that video games allow greater participation of students in the activities developed, which is why this type of digital resources are useful tools in the teaching and learning processes of fractional numbers. As a practical part of this step, it is recommended to use quizizz software, which has interactive games and activities on different topics.

**Step 4.**

**Evaluation and Feedback**

Assessment activities are relevant to measuring students' understanding and mastery of the topic of fractions. It is important to design interactive exercises that allow you to evaluate specific skills such as adding, subtracting, multiplying and dividing fractions. One of the functions that most strongly characterize the teacher's action in the classroom is constant evaluation and according to (Fandiño Pinilla, 2020), this process consists of at least three components: 1. From the didactic action itself, 2. From the chosen curricular segment and 3. From the learning process of the students themselves. Through interactive exercises, educators can identify areas of student strength and weakness in an accurate and timely manner. The evaluation material, called "Fraction Booklet – Digital.pdf", can be used and is available at the web address https://materialparamaestros.com/cuadernillo-de-fracciones/

The (National Commission for the Continuous Improvement of Education, 2021), recommends taking into account for the solution of problems that involve a verbal statement to define a strategy that allows its solution. In the case of multiplicative problem solving that includes, the following steps are recommended: 1. Read and understand the problem statement, 2. Identify data and unknowns, 3. Establish the direct proportionality relationship between the data, 4. Discern the operation to be carried out to answer the

problem question (multiplication or division), 5. Make the necessary calculations. 5. Check the result, 6. Interpret the result of the operation in the context of the problem.

## RESULTS

The results show a significant improvement in teachers' perception and use of ICT after the training:

- An increase in the frequency of use of digital resources and interactive activities.
- A positive perception regarding the usefulness of the method to teach fractions.
- Improvements in pedagogical practices, with greater integration of ICT in the classroom.
- Increase in student motivation and participation, evidenced by the responses in formative assessments.

For example, in the section on ICT use, responses in the highest options increased markedly after the intervention, indicating greater integration and trust in digital tools.

## DISCUSSION AND CONCLUSIONS

The implementation of the method contributed to transforming teaching practices, facilitating a more participatory and meaningful teaching of the subject of fractions. Evidence suggests that a pedagogical approach based on ICT and constructivist principles favors the conceptual and operational understanding of fractions, aligning with active learning theories.

It is confirmed that training and the use of digital resources enhance the role of the teacher as facilitator, promoting collaborative and motivating learning environments. The designed method proves to be viable, accepted and susceptible to being adapted to other curricular areas and educational levels.

In conclusion, the integration of ICT through a structured method based on constructivism can be an effective strategy to improve the teaching and learning of mathematics in official educational contexts, contributing to the development of digital and mathematical competencies in teachers and students.

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