

Enhancing Statistical Learning in Primary Education through Scratch: An Educational Intervention Study

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INTRODUCTION & AIM

- 1 Statistics is one of the most neglected areas in mathematics education in primary school. (Vásquez & Alsina, 2023)
- 2 The perception of mathematics as difficult generates anxiety and disinterest, affecting performance. (Deci & Ryan, 2000)
- 3 ICTs, specifically block-based programming (Scratch), allow combining computational thinking and problem-solving. (Moreno et al, 2021; Amores & De Casas, 2019)

Goal

Analyzes the effect of an intervention with Scratch vs. traditional methodology (textbook) in 5th grade of Primary School.



Hypotheses

- H1: Scratch improves attitude/motivation towards mathematics.
- H2: The experimental group (Scratch) will demonstrate greater conceptual understanding, offering better definitions of basic concepts.
- H3: Academic performance will be higher with the use of Scratch.
- H4: Scratch will be perceived as more user-friendly than the textbook.

METHOD

Design

- Quasi-experimental pretest-posttest with a non-equivalent control group.
- Sample: 47 fifth-grade students in Badajoz.
 - Experimental Group (EG): 23 students (Using Scratch).
 - Control Group (CG): 24 students (Traditional textbook).

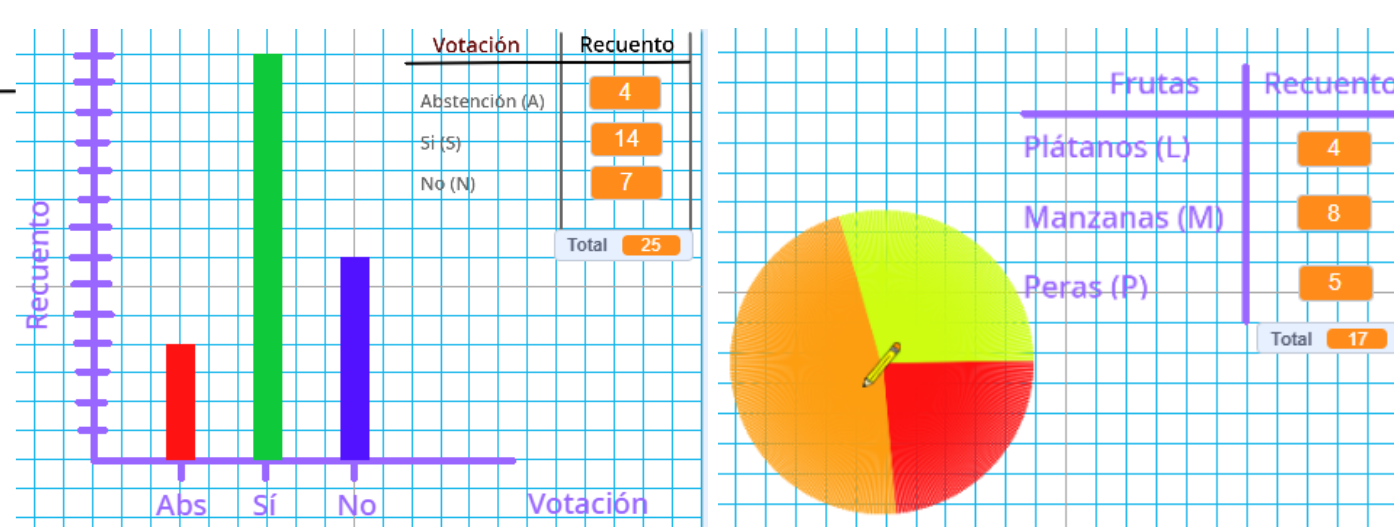
Intervention (12 sessions)

- Basic knowledge: Frequency tables, bar/pie charts, mean and mode.
- GE: Block programming in Scratch to work on these basic statistical concepts.
- GC: Lectures and paper exercises (traditional methodology, i.e., textbook and teacher as the main participants in the classroom).

Tools

- Questionnaires (Pretest/Posttest): Likert scale (attitude/usability) and open-ended questions (conceptual understanding).
- Objective test: Final academic performance exam, the same for both groups to avoid introducing extraneous variables into the research.

Color	Recuento
Blanco (B)	11
Azul (A)	9
Gris (G)	10
Total	30



RESULTS & DISCUSSION

Attitude/Motivation



Table 1. Mann-Whitney U test for independent samples in the comparison of groups (1st hypothesis)

	AttitudeMotivation_Mathematics_Pre	AttitudeMotivation_Mathematics_Post
Mean	2,59	2,65
Mann-Whitney U	270,000	255,000
Wilcoxon W	546,000	531,000
Z	-,130	-,454
Asymptotic Sig. (2-tailed)	,897	,650

Table 2. Wilcoxon test for related samples in the pretest-posttest comparison (1st hypothesis)

Group	MeanPre	MeanPost	Asymptotic Sig. (2-tailed)
Experimental	2,59	2,68	,836
Control	2,59	2,62	,317

Table 3. Mann-Whitney U test for independent samples in group comparison (2nd hypothesis)

	Definitions_Knowledge_Pre	Definitions_Knowledge_Post
Mean	2,555	2,660
Mann-Whitney U	261,500	147,000
Wilcoxon W	537,500	423,000
Z	-,321	-,275
Asymptotic Sig. (2-tailed)	,748	,006

Table 4. Wilcoxon test for related samples in the pretest-posttest comparison (2nd hypothesis)

Group	MeanPre	MeanPost	Asymptotic Sig. (2-tailed)
experimental	2,540	1,570	,000
Control	2,570	2,180	,003

Note. In this hypothesis, unlike the others, the closer to one is the most positive.

Conceptual understanding



Academic performance



Table 5. Average scores of the groups participating in the study.

Group	Scores	N	Mean
Experimental	Valid Number (per list)	23	7,9696
control	Valid Number (per list)	24	7,0333

Table 6. Student's t-test for independent samples in the comparison of groups (3rd hypothesis)

	t	Sig. (2-tailed)
Scores	2,075	,044

Table 7. Descriptive statistics for the fourth hypothesis

Group	N	Mean	
experimental	Usability	23	4,0217
	Valid Number (per list)	23	
control	Usability	24	3,0000
	Valid Number (per list)	24	

Table 8. Mann-Whitney U test for independent samples in the comparison of groups (4th hypothesis)

	Usability
Mann-Whitney U	72,000
Wilcoxon W	372,000
Z	-,435
Valid Number (per list)	,000

Usability



CONCLUSIONS

- 1 Scratch significantly improves academic performance and conceptual understanding of statistics compared to the traditional method.
- 2 Students perceive Scratch as a more usable and attractive tool than the textbook.
- 3 No immediate changes in attitude towards mathematics were achieved, suggesting the need for longer-term interventions.
- 4 The study provides preliminary evidence of Scratch's potential for teaching statistics in primary education.

REFERENCES

