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Original

APLICACIÓN DE METODOLOGÍAS COOPERATIVAS Y COMPETITIVAS EN EDUCACIÓN FÍSICA PARA MEJORAR LA CAPACIDAD DEL LANZAMIENTO Y REDUCIR LAS DIFERENCIAS DE GÉNERO

PROMOTING COOPERATIVE AND COMPETITIVE PHYSICAL EDUCATION METHODOLOGIES FOR IMPROVING THE LAUNCH'S ABILITY AND REDUCING GENDER DIFFERENCES

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RESUMEN

El objetivo de este estudio es observar las diferencias de género en la eficiencia del aprendizaje del lanzamiento como habilidad motora fundamental utilizando dos métodos de intervención diferentes: cooperativo y competitivo. El instrumento fue capaz de probar y analizar la capacidad motriz del lanzamiento al inicio y al final de la intervención a partir de tres factores de investigación: a) participación del estudiante en la actividad al inicio y al final del proceso de aprendizaje, b) nivel motor en relación a las características cualitativas, y c) aspectos cuantitativos a nivel motor alcanzados con el lanzamiento. Los hallazgos muestran que el aprendizaje cooperativo y competitivo son métodos efectivos para generar resultados superiores en términos de participación en la tarea, características cualitativas y cuantitativas a nivel motor y fomentar un proceso de aprendizaje más equitativo entre los estudiantes. Se encontraron diferencias de género, en los niños el mayor progreso se produce cuando se utiliza la técnica competitiva, mientras que las niñas y los niños lograron resultados comparables cuando se utilizó la metodología cooperativa.

Palabras clave: Educación Física, aprendizaje cooperativo, género, capacidad de lanzamiento, escolares.

ABSTRACT

The goal of this study is to look at gender differences in the efficiency of learning throwing as a fundamental motor skill using two different intervention methods: cooperative and competitive. The instrument was able to test and analyze the motor capability of the throw at the start and end of the intervention based on three research factors: a) student participation in the activity at the start and end of the learning process, b) motor level qualitative features, and c) motor level quantitative aspects attained with the launch. The findings show that cooperative and competitive learning are effective methods for generating superior outcomes in terms of task involvement, qualitative and quantitative features at the motor level, and fostering a more equitable learning process among students. Gender differences were found, with boys demonstrating the greatest progress when the competitive technique was used, whereas girls and boys achieved comparable outcomes when the cooperative methodology was used.

Keywords: physical education, cooperative learning, gender, launch ability, school students.



INTRODUCTION

In order to attain good learning outcomes, current physical education (PE, hereafter) must be aligned with a teaching and learning process that leads to the development of students' cognitive, social and interpersonal skills (Dovala, 2014, Rijo et al., 2021, Cañabate et al., 2021a). According to authors such as León-Díaz et al. (2020), these considerations should be in line with the current guidelines of the National and International Reporting Committee outlining the policies to be followed in order to offer best standards in the PE area, which promotes the use of more situated approaches that engage students' active participation in their learning, which is contextualized, transversal, and competence-based, while leaving the most traditional models, which are centered on teaching and performance, in the background (León-Díaz et al., 2020).

Active methodologies include: problem-based learning, challenge-based learning, cooperative learning, project-based learning, gamification, flipped classroom, service-learning, case method analysis, modelling learning environments, and hybrid learning. All of them are framed within pedagogical models based on a relationship of interdependence between teaching and learning, and between the content and the context (Fernández-Rio et al., 2018). These active methodologies offer more formative, deeper, meaningful, and situated processes (Cañabate et al., 2020a, Colomer et al., 2021). The implementation of these methodologies in all educational systems requires critical and reflective strategies in order to develop a comprehensive PE (Pérez-Pueyo et al., 2020, Cañabate et al., 2021b).

Cooperative learning is an educational strategy in which students work together in small, heterogeneous groups to help each other learn and to achieve a common goal that is characterized by a structure that promotes positive interdependence among group members (Johnson & Johnson, 2009). During the learning process, students provide and receive feedback from their classmates, as well as the teacher's support, both strategies increasing the students' learning outcomes (Chen 2002, Altun, 2015, Cobas, 2016, Cañabate et al., 2021b). Students collaborate and exchange ideas and resources to learn something new for themselves while also encouraging other team members to learn (Cañabate

et al., 2019a). Cooperative learning is a type of learning in which students collaborate on a project to identify and solve a problem, share ideas, or activate research. Reflective learning, which is described as acquiring durable knowledge and abilities via self and interpersonal interactions, also activates skills and encourages students' dialogue and deliberation, as well as peer engagement in resolving strategic actions (Colomer et al., 2020).

According to Johnson et al. (2014, 2017) for cooperation within a small group, several essential elements must be present. These components distinguish cooperative learning from teamwork and are as follows: (a) Positive interdependence: the learning of the team members depends on the actions performed by each member of the group; (b) Face-to-face interaction: at some point in the process, group members work face to face, improving their social adjustment and competence; (c) Individual responsibility: without the success of others, no one in the group can prosper; (d) Development of interpersonal skills in small groups: students must learn interpersonal and communication skills along with other skills to achieve common goals; and (e) Group processing: a cooperative group works well when it reflects on its performance. Several authors also claimed that cooperative learning also develops positive correlation achievements, achievement of shared goals, development of interactive processes, understanding of cooperation as the key issue to learning, and promotion of diversity (Heredia & Duran, 2013, Lata & Castro, 2016, Azorín, 2018).

In recent decades, cooperative learning has been successfully implemented as a methodology and method of practical teaching in contrast to traditional teaching methods (Slavin, 2011, Johnson et al., 2013). In this regard, numerous studies have been conducted on cooperative learning that demonstrate its effectiveness in academic performance in various fields and at various educational levels (Byra, 2006, Colomer et al., 2018, Johnson et al., 2000, Cañabate et al., 2020b). Cooperative learning also promotes the emotional, cognitive and social development of students (Cañabate et al., 2018a; Cañabate et al., 2018b, Morgan 2019) and is considered as a methodological approach capable of responding to individual students' needs (Cobas 2016, Johnson & Johnson, 2017, Velázquez, 2018, Díaz-Iso et al.,



2019, Ayers et al., 2020, Colomer et al., 2021). Cooperative learning empowers students to change their way of thinking and working towards a sustainable future by confronting dilemmas with other students while activating cooperation (Fuertes-Camacho et al., 2019, Tejedor et al., 2019, Fernández-Rio et al., 2018).

In the area of PE, cooperative learning has been successfully developed in a large number of curricula and competence development: basic skills (Dyson, 2012, Fernández-Rio, 2000, Grineski, 1996), gymnastic skills, physical condition and health (Grineski, 1996), expressive activities (Pérez, 2014) and rhythmic activities. PE promotes the development of motor skills, cognitive comprehension, social skills and emotional development of students (Casey et al., 2009, Cañabate et al., 2018b, Morgan 2019, Velazquez, 2021). Velázquez (2018) evaluated the perspectives of 198 instructors from throughout Spain and concluded that PE teachers were aware of the foundations of cooperative learning and considered it as a highly beneficial educational strategy for students' motor and emotional development. This study also describes how cooperative learning improves the basic ability of the launch through different types of tasks: cooperative physical challenges, cooperative games (Ruiz Omeñaca, 2017, Velázquez, 2015), and cooperative corners (Fernández-Rio et al., 2013).

Cooperative physical challenges are cooperative learning activities that have a clearly defined goal and are posed as a collective challenge (team) in which the group, in the first stage, must solve a specific problem using multiple solutions and in the second stage, reflect on the whole process. Each team needs to not only agree on its actions as a group but, more importantly, consider and assess the individual characteristics of each and every one of its members to solve the problem. While a specific answer to completing the challenge may be valid for one team, it may not be valid for another. Cooperative physical challenges maximize the acquisition of skills through individual cooperation in teamwork, the intrapersonal construction of professional identity and the definition of strategic decision actions (Navarro-Paton et al., 2017, Cañabate et al., 2019a).

Launches and receptions in PE belong to the education area of basic motor skills and abilities. Pattern launches are considered by motor development experts to be fundamental to the evolution of the motor competence (Mukherjee et al., 2017, Wu et al., 2021). Throwing is a basic skill by which the individual detaches himself from a mobile, pushing it with hands or feet and even striking with the intention of sending it to a certain point or distance, which can be done from a static or dynamic position and requires the global participation of the student (Lukács & Kemény, 2015). Learning this skill can be developed through different methodologies and learning strategies, from open proposals (games and challenges), through active methodologies such as cooperative learning, problem solving and guided discovery and through closed activities with more directed proposals (circuits), and through traditional methodologies such as task assignment and direct command.

It should be noted that the learning of launches involves the development of general dynamic coordination, visual motor coordination and laterality (Solum et al., 2020). Because they are skills in which a single body hemisphere often intervenes or predominates, it is advisable to work consciously with both the right and the left hand, both separately and together. Learning must start from the natural and spontaneous movement exploring all the possibilities and variants of the movement, from movements that require control and coordination and from the simplest movements to those that require more complex coordination (Du et al., 2017). The practice must be varied, focused on modifying aspects of the technical gesture or the surroundings to modify the motor performance of the student in order to increase the variability of the gesture and thus increase the baggage of motor experiences (Schmidt & Lee, 2011, Hernández-Davó et al., 2014a, Rosa et al., 2019, Shams et al., 2021).

Several studies point to gender-related motor differences, where boys show better scores on motor tests (Cenizo-Benjumea et al., 2019), specifically in early stages (Temple et al., 2016), childhood (Sgrò et al., 2017) and adolescence (Jiménez-Díaz et al., 2015). In contrast, other studies indicate girls' superiority, as girls score better in locomotion, although there are no differences in object control



(Cliff et al., 2009; Blanca-Torres et al. 2019, Barnett et al. 2010, Freitas et al., 2015, Hardy et al., 2010). Specifically, in the basic motor skill of launch, studies have shown that boys tend to have a superior mastery than girls (Bolger et al., 2020, Bravo et al., 2017, Temple et al. 2016).

The purpose of this research is to compare the effectiveness of a cooperative educational approach in improving the learning of the fundamental skill of hand throwing to other methodologies, such as the competitive and individualistic ones, which are also used in physical education through direct command, and task assignment.

METHODS

Participants

The sample consisted of 92 kids in PE sessions in their third and fourth years of elementary school, with an average age of 9.5 years and a ratio of 59.78 percent males and 40.22 percent girls. Four primary school teachers - tutors and two physical education experts - also took part in the study (Table1).

Table 1. Sample distribution

	Cooperative methodology	Competitive and individualistic methodology	Total
Boys (3rd-4th)	25 (55.6%)	30 (63.8%)	55 (59.8%)
Girls (3rd-4th)	20 (44.4%)	17 (36.2%)	37 (40.2%)
Total	45	47	92

Ethical considerations

The whole research process was carried out with the prior authorization of the teachers and students involved in the research. All participants were informed of the objectives of the study, as well as the conditions of participation. The use of data took into account ethical principles and ensured anonymity. This study was approved by the Research Ethics Committee (REC) of the University of Girona in 2020.

Method

The study was structured in three phases. In line with Cañabate et al. (2018b) the goal was to create a specific classroom climate to motivate students to participate in all phases of the research project. The intrinsic motivation and organization of the tasks were closely linked to a motivational climate focused on the task in question (Chacón et al. 2017, Posso-Pacheco et al., 2022). In the first phase, the entire program was explained to the students, including the set of activities and the assessment and self-assessment system.

In the second phase, the classes were dedicated to implementing the different activities. In this phase the eight sessions of PE (Table 2 and 3) were carried out four days a week (each session is performed 4 times, once per course) therefore, the intervention lasted six full weeks. Each of the activities was related to the curriculum for the middle cycle of PE in Spain and also to the objectives of a sustainable education. The proposed educational approach aims to promote the development of skills specific in the area of PE: solve motor situations effectively in the practice of physical activities and be aware of the limits and possibilities of the body in performing physical activities. The focus is also on developing two of the goals of sustainable education: Gender equality and reducing inequalities.

As a result, the methodological principles were developed with the goal of presenting activities that originated in a variety of settings, that are functional (i.e., related to real-life circumstances), and need deliberate and intentional management in their execution. Teachers must be able to demand the maximum of each individual's particular form by proposing tasks with various levels of difficulty that adapt to the various levels of students. All of this is done while taking into account the learner's physiological demands, evolutionary stage, and the features of the group-class in order to help the student to become aware of their own boundaries and capabilities. When undertaking physical activities, the body presents a diverse and motor-rich environment that allows for as many experiences as feasible. Variation and variability were prioritized above specialization, which will be acquired in later stages through the development of specialized motor



abilities. Using a variety of tactics and resources will also enable teachers in PE to provide a more comprehensive student's educational response (Hernández-Davó, et al., 2014b).

The cooperative methodology led to four sessions through cooperative physical challenges, two sessions through cooperative games and two sessions through cooperative corners. In relation to the competitive and individual methodology it has been developed through activities carried out with direct command and assignment of tasks. Two sessions through pre-sports games, two sessions conducted through station circuits, two sessions using competitive games and two sessions through traditional games, were developed.

The final evaluation was carried out through the questionnaire in the third phase (week eight), and the results were discussed among the students in order to reflect and make them aware of the learnings, as well as how they were attained.

Table 2. Sessions and cooperative activities

Cooperative methodology		
Sessions	Objectives	Activities
1st and 2nd Cooperative physical challenges	Work cooperatively with the group to achieve different challenges of the motor skill of the launch and its possible variants (dominant hand, non-dominant hand, closed eyes, two hands and moving).	Implementation of cooperative physical challenges built by the research team and teachers of PE of the school. Some excerpts from the book PE and Cooperative Physical Challenges.
3rd and 4th Cooperative games	Learn to make precise throws to reach the receiver and properly control the reception of the partner. Work cooperatively to make a target with different material. Launch accurately to knock down as many obstacles as possible Master the passes and control of the ball with a dominant and non-dominant hand. Recognize the difficulties and	The burning ball. The midnight train. Colpbol. Cooperative relays. The throwing chain. Prisoner team game. We reject the balls. Move the cone. Let's all launch. (among others)

	facilities in performing the different tasks and variants of the launch.	
5th and 6th Cooperative corners	Foster trust and teamwork in order to coordinate and launch. Perform the maximum number of launches with different variants and materials to obtain precision and effectiveness. Find out what difficulties and facilities the different groups have had in carrying out each corner to self-regulate their learning.	The hunting ball. You can I can. Launch that we are a team! Think and act. Throw and follow me. I throw at you. Throw and collect. (among others)
7th and 8th Cooperative physical challenges	Perform the maximum number of launches with different variants and materials to obtain precision and effectiveness Practice and improve the throwing accuracy: dominant hand, non-dominant hand, two hands, moving and with eyes closed	Realization of cooperative physical challenges built by the research team and teachers of Physical Education of the school. Some excerpts from the book Physical Education and Cooperative Physical Challenges

Table 3. Sessions and competitive activities

Competitive methodology		
Sessions	Objectives	Activities
1st and 2nd Pre-sports games	Practice different types of passes from different throwing variants: dominant hand, non-dominant hand, with two hands. Perform many precision throws to touch the maximum number of players and get the highest score first (10 points). Make precise throws with different variants so that they reach the partner and, at the same time, perform the throw correctly. Make throws with the ball and move through the	The burning ball. Dodge and run Picture game Star game Game Seven and a half Round trip boat. Ball at home. Four-corner ball. Ball in 2 fields: black or white. Ball Touch. Frisbee match. Basketball-rugby match (among others)



	game in order to increase the degree of agility, coordination and accuracy of the throw. Throw a plate accurately and effectively at a marked target on the ground to get the correct score (seven and a half).	
3rd and 4th Station circuits	Perform the maximum number of launches with different variants and materials to obtain accuracy and efficiency.	Station circuits with different difficulties in terms of space, accuracy, time, and material.
5th and 6th Competitive games	Perform the maximum number of throws during a given time. Make precise throws so that they reach the receiver. Perform the maximum number of throws accurately. Work the pass, boat and throw in game situations.	I play the basket. Hunters and hares. Numbered ball. Positional game. Poisoned ball. Balls out. Variants of handball. Basketball variants. Variants of hockey. (among others)
7th and 8th Traditional games	Perform the maximum number of launches with different variants and materials to obtain precision and effectiveness. Practice and improve the accuracy of the launch.	Homemade bolos. Ping-pong baskets. The rings. Throw away the boats. Rings in bottles. (among others)

Methods

An adaptation of Ulrich's (2013) Gross Motor Develop test has been used with other studies and instruments provided by Ureña et al. (2006), and Derri et al. (2007). This instrument has allowed to evaluate and analyze the motor ability of the launch at the beginning and at the end of the intervention. The goal-scoring technique was used as a recording/observation technique to obtain information on different variables: a) involvement of students during the activity at the beginning and end of the educational intervention. Indicators were used for evaluation and analysis: low, adequate, good and excellent (Ureña et al., 2006), b) qualitative aspects of the motor level. The maturing stage of the development of the launch has been taken into account for its assessment and analysis: motor and visual-motor coordination, arm width, trunk position, position of the lower extremities and accompanying movement of the body, and using the evaluation

criteria of: novice, apprentice, expert and distinguished, and c) quantitative aspects of the motor level reached with the launch. The qualitative aspects of the launch have been taken into account: motor coordination and motor oculus, arm width, arm position, position of the trunk, position of the lower extremities, accompanying movement of the body (Ureña et al., 2006, Derri et al., 2007).

RESULTS

Students' involvement during the activity

The initial (i) and final (f) assessment with respect to student involvement during the activity with both methodologies is presented in Table 4. In the initial evaluation (first session) and through the cooperative methodology, there is no student who has little involvement in the activity, but a clear difference between genders is evident in the involvement. It is observed that while no boy has an adequate involvement, in contrast it is observed that 25% of girls do have an adequate involvement. Mostly the level of student involvement is between good and excellent involvement. In relation to a good involvement, it is observed that it is accounted by 24% of boys and 40% of girls. A greater number of students with an excellent involvement is observed, leaving an average of 13 ± 8.5 students in this category. However, it should be noted that, in relation to girls, their percentages are fairly equitable between adequate involvement (25%), good (40%) and excellent (35%). In contrast, in the competitive and individualistic methodology, no significant differences between genders are observed, as 20% of boys and 17.7% of girls present it. Then, when comparing the last two implications, the good and the excellent, there is very little difference between the two with respect to boys. It is observed that 40% of the boys show a good involvement and 36.6% have an excellent involvement. In contrast, 52.9% of girls were in good involvement and only 29.4% had an excellent involvement.

Table 4. Initial (i) and final (f) results of the level of student involvement with either the cooperative methodology or the competitive and individualistic methodology.

In	Students		%		M i/f	TD i/f
	B i/f	Gi i/f	Bs i/f	Gi i/f		
C	L	0/0	0/0	0/0	0/0	0/0



M	A	0/0	5/0	0/0	25/0	2.5/0	3.5/0
	G	6/5	8/10	24/20	40/50	7/7.5	1.4/3.5
	E	19/20	7/10	76/80	35/50	13/15	8.5/7.1
C	L	1/0	0/0	3.3/0	0/0	0.5/0	0.7/0
	A	6/0	3/0	20/0	17.6/0	4.5/0	2.1/0
	G	12/13	9/11	40/43.3	52.9/64.7	10.5/12	2.1/1.4
m	E	11/17	5/6	36.6/56.6	29.4/35.3	8//115	4.2/7.8

Cooperative methodology: CM; Competitive methodology: CmM; Low: L; Girls: Gi; Boys: B; Good: G; Excellent: E; Involvement: In; Median: M; Typical Deviation: TD; Adequate: A.

All this seems to confirm that the largest number of students in the initial assessment has a good involvement, leaving a median of 10.5 ± 2.1 students in this category. In relation to the final evaluation of the cooperative methodology, some boys and girls who previously had a good involvement showed excellent involvement: 80% of boys and 50% of girls. Thus, a median of 15 ± 7.1 students in this category of involvement was found. With the competitive and individualistic methodology, the percentage of students in excellent involvement increased significantly, obtaining 56.6% in boys and 35.3% in girls. However, girls continued to show a higher percentage of the level of good involvement (64.7%). These results show that the median is higher in the category of good involvement (12 ± 1.4 students) than in the excellent involvement category (11.5 ± 7.8 students).

Qualitative aspects of the launch

-Cooperative methodology

The results in relation to the initial and final level of the basic qualitative aspects of the launch with cooperative methodology can be seen in Table 5. In the initial assessment it is highlighted that both boys and girls are at a novice and apprentice level in all five qualitative aspects of the launch. The qualitative aspects of the launch where the students present a novice level were: the width of the arm with respect to the girls (65%); the position of the trunk in both genders (64% boys and 60% girls); and the accompanying movement also in both genders (68% boys and 90% girls). On the other hand, the qualitative aspects of the launch with a learning level

were: motor and oculomotor coordination in both genders (56% boys and 65% girls); arm width relative to children (52%); and, finally, the position of the lower extremities, also in both genders (72% boys and 80% girls), with the lowest median of 13.5 ± 0.7 students.

One last aspect to note is that the category distinguished is not presented by any student, with the exception of motor and oculomotor coordination and the accompanying movement, where one boy is observed in both cases. On the contrary, if we analyze the final evaluation of the qualitative aspects of the launch, it is observed that the level of the students has gone from novice and apprentice, to apprentice and expert, in all the qualitative aspects. In this analysis, as in the previous one, a clear difference between genders is observed, since boys in all qualitative aspects have a higher percentage at the expert level, with the lowest percentage (64%) in the position of the lower extremities and the highest percentage in motor and oculomotor coordination with 76% of boys at the expert level. In contrast, girls in all five qualitative aspects showed a higher percentage in the learning level, while obtaining the lowest percentage at this level in the position of the lower extremities (70%) and the highest percentage in the amplitude of the arm (95%). Because of the experimental gender disparities, the averages of the apprenticeship and expert levels are comparable in all five qualitative dimensions. First, the median motor and oculomotor coordination was highest at the expert level with 11.5 ± 10.6 students. Following the expert level, the position of the lower extremities took place with an 11 ± 7.1 students. Then, the median increases for the width of the arm (13 ± 8.5 students), the position of the trunk (11 ± 7.1 students) and the accompanying movement (11.5 ± 5.0 students). Finally, it should be noted that in the position of the trunk and lower extremities, in both cases, 8% of boys are observed at the distinguished level.

Table 5. Initial and final data in relation to the qualitative aspects of the launch of students with cooperative methodology.

Initial and Final Evaluation							
QC	L	Students		%		M	TD
		B	Gi	B	Gi		
		i/f	i/f	i/f	i/f		
MO	N	4/0	6/0	16/0	30/0	5/0	1.4/0



M	Ap	14/5	13/16	56/20	65/80	13.5/0.5	0.7/7.8
	Ex	6/19	1/4	24/76	5/20	3.5/11.5	3.5/10.6
	D	1/1	0/0	4/4	0/0	0.5/0.5	0.7/0.7
AW	N	6/0	13/0	24/0	65/0	9.5/0	5.0/0
	Ap	13/7	7/19	52/28	35/95	10/13	4.2/8.5
	Ex	6/18	0/1	24/72	0/5	3/9.5	4.2/12.0
	D	0/0	0/0	0/0	0/0	0/0	0/0
PT	N	16/0	12/0	64/0	60/0	14/0	2.8/0
	Ap	8/6	8/16	32/24	40/80	8/11	0/7.1
	Ex	1/17	0/4	4/68	0/20	0.5/10.5	0.7/9.2
	D	0/2	0/0	0/8	0/0	0/1	0/1.4
PLE	N	3/0	4/0	12/0	20/0	3.5/0	0.7/0
	Ap	18/7	16/14	72/28	80/70	17/10.5	1.4/5.0
	Ex	4/16	0/6	16/64	0/30	2/11	2.8/7.1
	D	0/2	0/0	0/8	0/0	0/1	0/1.4
AM	N	17/0	18/0	68/0	90/0	17.5/0	0.71/0
	Ap	7/8	2/15	28/32	10/75	4.5/11.5	3.5/5.0
	Ex	0/17	0/5	0/68	0/25	0/11	0/8.5
	D	1/0	0/0	4/0	0/0	0.5/0	0.7/0

Qualitative categories: QC; Motor and oculomotor coordination: MOC; Arm width: AW; Position of the trunk: PT; Position of the lower extremities: PLE; Accompanying movement: AM; Level: Le; Novice: N; Apprentice: Ap; Expert: Ex; Distinguished: D; Girls: Gi; Boys: B; Median: M; Typical Deviation: TD.

Competitive and individualistic methodology

Table 6 shows the findings of the qualitative components of the launch using the competitive and individualistic technique. In all five qualitative aspects of the launch, both boys and girls present a novice and apprentice level, except for the first category, motor and oculomotor coordination, where the apprentice level (60% boys and 58.8% girls) and the expert level (60% boys and 58.8% girls) stand out the most (30% boys and 23.5% girls). There were significant distinctions between motor and oculomotor coordination. With the exception of the position of the lower extremities, where they present 76.5% at the apprentice level, girls mostly present a novice level in all four remaining qualitative aspects - arm amplitude with 52.9%, trunk position with 76.5%, and accompanying movement with a 82.4%. In comparison, boys present 56.6% of the arm amplitude and 83.3% of the lower extremity position. In terms of trunk position, it has been discovered that

in boys, there is a 46.6% between the novice and apprentice levels in both circumstances. On the contrary, when it comes to the quality component of the accompanying movement, boys, like girls, have a greater percentage of novices (53.3%). Finally, it should be highlighted that no student scored highly in any of the five qualitative components of the launch during this initial assessment.

When the degree of final maturity of the qualitative aspects of throwing in boys and girls was examined, it can be shown that the students' level progressed from novice to apprentice, apprentice to expert in all qualitative aspects. The results show clear gender differences once again. In four of the five qualitative components of the launch, the girls primarily display an apprentice level. They scored 58.8% in motor and oculomotor coordination at the apprentice level, 64.7% in arm amplitude and trunk position, and 82.4% in the accompanying movement.

At the expert level, boys had a larger proportion than girls. They score 56.6% in motor and oculomotor coordination at the expert level, followed by 66.6% in arm amplitude, 63.3% in lower extremity position, and 56.6% in following movement. It should be mentioned, however, that both genders have achieved expert status in the qualitative element of lower extremity posture (63.3% boys and 58.8% girls). As a result, a median of 14.5 ± 6.4 pupils remains. The distinguished level is used in this final evaluation. It may be shown in motor and oculomotor coordination, with a median of 2 ± 1.4 students, and in arm amplitude and lower extremity position, with the same median in both (0.5 ± 0.7 students).

Table 6. Initial and final data in relation to the qualitative aspects of the launch of students using the competitive methodology.

Initial and Final Evaluation							
QC	L	Students		%		M	TD
		B	Gs	B	G		
		i/f	i/f	i/f	i/f	i/f	i/f
MOC	N	3/0	3/0	10/0	17.7/0	3/0	0/0
	AR	18/10	10/10	60/33.3	58.8/58.8	14/10	5.7/0
	E	9/17	4/6	30/56.6	23.5/35.3	6.5/11.5	3.5/7.8
		0/3	0/1	0/10	0/5.9	0/2	0/1.4
AW	N	6/0	9/0	20/0	52.9/0	7.5/0	2.1/0
	AR	17/10	6/11	56.6/33.3	35.3/4.7	11.5/1	7.8/0.5



	E	7 / 20	2 / 5	23.3 / 66.6	11.8 / 29.4	4.5 / 12.5	3.5 / 10.6
	D	0 / 0	0 / 1	0 / 0	0 / 5.9	0 / 0.5	0 / 0.7
PT	N	14 / 0	13 / 0	46.6 / 0	76.47 / 0	13.5 / 0	0.7 / 0
	AR	14 / 15	4 / 11	46.6 / 50	23.53 / 64.7	9 / 13	7.1 / 2.8
	E	2 / 15	0 / 6	6.6 / 50	0 / 35.3	1 / 10.5	1.4 / 6.4
	D	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
PLE	N	1 / 0	3 / 0	3.3 / 0	17.7 / 0	2 / 0	1.4 / 0
	AR	25 / 10	13 / 7	83.3 / 33.3	76.5 / 41.2	19 / 8.5	8.5 / 2.1
	E	4 / 19	1 / 10	13.3 / 63.3	5.9 / 58.8	2.5 / 14.5	2.1 / 6.4
	D	0 / 1	0 / 0	0 / 3.3	0 / 0	0 / 0.5	0 / 0.7
AM	N	16 / 0	14 / 0	53.3 / 0	82.4 / 0	15 / 0	1.4 / 0
	AR	13 / 13	3 / 14	43.3 / 43.3	17.7 / 82.4	8 / 13.5	7.1 / 0.7
	E	1 / 17	0 / 3	3.3 / 56.6	0 / 17.7	0.5 / 10	0.7 / 9.9
	D	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0

Qualitative categories: QC; Motor and oculomotor coordination: MOC; Arm width; AW; Position of the trunk: PT; Position of the lower extremities: PLE; Accompanying movement: AM; Apprentice: AR; Novice: N; Expert: E; Distinguished: D

- Analysis of the motor level reached with the launch

This section of the results analysis will display the number of students' initial and final throws for each type of throw - dominant hand, non-dominant hand, two hands, with movement, and closed eyes (0, 5, 10, and 20). The number of hits is also provided, as well as the arithmetic mean of hits during the course of the test, revealing four aspects: the methodology employed, the gender of the participants (boys and girls), and the time of the start and final evaluations (Table 7).

According to the cooperative technique, the dominant hand throw is the first to be analyzed. It has been discovered that both boys (80%) and girls (90%) have a significant percentage of score 0. In the final review, this element is replicated, albeit with a lesser proportion (69% in boys and 73.8% in girls). The throw to ten points has improved dramatically, with the boys scoring 3% and the girls scoring 3.8% in the initial review, and the boys scoring 10% and the girls scoring 9.4% in the final evaluation. The second type of throw, non-dominant hand, has obtained a greater number of throws at 0. However, a notable improvement is observed in the throw at 5 points,

where the boys have gone from 5% of releases to 9.5% and the girls have gone from 4.4% to 11.9%. With both hands is the third sort of launch to highlight. It is worth looking at the female gender in this form of launch since, rather than dropping to 0 points, the proportion of launches has climbed in the final evaluation (83.1% in the initial and 84.4% in the final). The similar pattern emerges when the number of shots is counted at 5 and 10 points. However, if improvements are noticed in the 20 points. Girls have gone from 1.3% of throws to 20 in the initial evaluation, and from 5% of throws to 20 in the final evaluation. The highest proportion of shots at 0 points is replicated in the last two categories of shots, shot with movement and shot with eyes closed. The percentage of final throws in scores 5 (6% boys and 8.1% girls), 10 (4.5% boys and 7.5% girls), and 20 (13% boys and 5.6% girls) in the throw with eyes closed has improved compared to the original conditions. Shots made with the dominant hand and both hands have a larger percentage of shots in the 20 score.

In contrast, before studying each kind of launch independently, it is crucial to note that, regarding the competitive methodology, in the initial evaluation, the difference between both genders is quite small. The most significant distinction is discovered in the non-dominant hand (85% for boys and 89.4% for girls). However, gender inequalities widen in the final evaluation, particularly in throwing with a non-dominant hand (74.6% for boys vs. 79.4% for girls) and throwing with movement (71.7% for boys and 77.2 % for girls). When it comes to throwing with a dominant hand, it is worth noting that even when the number of throws is reduced to 0, the score of 20 for both genders shows the most significant improvement, with a percentage of 17.1% in boys and 7.4% in girls. Throwing with both hands yields similar outcomes (12.1 in boys and 7.3% in girls).

In non-dominant hand throwing, both genders gain by a score of ten. Boys, on the other hand, improve more at score 20 (9.6%) than girls at score 5 (11.0%). In terms of the launch with movement, it's worth noting that all of the ratings improved significantly in the final evaluation when compared to the original one. However, it is important to note that in the case of girls the most notable improvement is in the 5-point throw (initial evaluation 9.6% and final evaluation 14.0%) and in the boys in the 20-point



throw, with an initial evaluation of 5.8% and a final evaluation of 11.2%.

A drop in the final percentage of shots to 0 is also noticed in the shot with eyes closed, although the difference is considerably lower than in the other types of shots analyzed. The boys received 83.8% and the girls a 82.3% in the initial review, but in the final evaluation, the boys received just 80.4% and the girls a 81.6%. Finally, it should be mentioned that, as a result of the competitive and individualized methods, all of the students' motor skills in all forms of throwing have improved.

Table 7. Initial and final data of the motor level reached with the launch of the students through the cooperative methodology and the competitive and individualistic methodology.

	Cooperative methodology				Competitive methodology			
	Pt	N° T		% N° T		N° T	% N° T	
		B	Gi	B	Gi		B	Gi
		i/ f	i/ f	i/ f	i/ f	i/ f	i/ f	i/ f
DH	0	160/138	144/118	80/69	90/73.8	185/165	109/99	77.1/ 80.2/ 68.8 72.8
	5	16/15	7/17	8/7.5	4.4/ 10.6	18/19	16/20	7.5/ 11.8/ 7.9 14.7
	10	6/20	6/15	3/10	3.75/ 9.4	20/15	7/7	8.3/ 5.2/5.2 6.3
NDH	0	170/150	143/125	85/75	89.4/ 78.1	200/179	119/108	83.3/ 87.5/ 74.6 79.4
	5	10/19	7/19	5/9.5	4.4/ 11.9	21/18	7/15	8.8/ 5.2/ 7.5 11.0
	10	13/13	8/10	6.5/6.5	5/6.3	7/20	2/8	2.9/ 1.5/5.9 8.3
TH	0	160/140	133/135	80/70	83.1/ 84.4	206/184	112/100	85.8/782.4/ 6.6 73.5
	5	16/20	17/11	8/10	10.6/ 6.9	16/20	11/16	6.6/ 8.1/ 8.3 11.8
	10	9/8	8/6	4.5/4	5/3.75	8/7	9/10	3.3/ 6.6/7.4 2.9
WM	0	162/145	137/127	81/72.5	85.6/79.4	203/172	115/105	84.6/784.56/7 1.6 7.2
	5	15/20	12/18	7.5/10	7.5/11.3	15/22	13/19	6.3/ 9.56/ 9.2 14.0
	10	9/13	6/10	4.5/6.5	3.8/6.3	8/12	5/8	3.3/5 3.68/ 5.9
EC	0	171/153	138/126	85.5/ 76.5	86.3/ 78.8	201/193	112/111	83.8/ 82.4/ 80.4 81.6
	5	9/12	7/13	4.5/6	4.4/8.1	26/13	11/15	10.8/ 8.1/ 5.4 11.0

10	5/9	9/ 12	2.5/4.5	5.6/7.5	11/12	10/3	4.6/5	7.4/2.2
20	15/26	6/9	7.5/13	3.8/5.6	2/22	3/7	0.8/ 9.2	2.2/5.2

Dominant hand: DH; Non dominant hand: NDH; Two hands: TH; With movement: WM; Eyes closed: EC; throwings: T;

Table 8 presents the averages and standard deviations of the scores at the beginning and end of learning (assessment time) according to the method used and the gender. The results of the ANOVA of the mixed design (Time of assessment/Methodology/Gender) indicate that there is no third-order interaction ($F = 0.01$; $p = 0.93$), nor second-order interaction between the time and the methodology ($F = 0.65$; $p = 0.42$), between time and gender ($F = 1.15$; $p = 0.286$) or methodology and gender ($F = 1.03$; $p = 0.31$). The effects of methodology ($F = 0.51$; $p = 0.48$) and gender ($F = 3.55$; $p = 0.06$) are also not significant. In contrast, a significant effect of the assessment time is observed: all participants increase the launch score after applying the instructional approach ($F = 52.0$; $p < 0.001$; $\eta^2 = 0.37$).

Table 8. Descriptive indices of the launch scores in the two evaluated moments (initial / final) according to the learning method (competitive / cooperative) and the gender.

	Boys		Girls	
	Initial Mean (SD)	Final Mean (SD)	Initial Mean (SD)	Final Mean (SD)
Cooperative	6.72 (2.54)	10.76 (3.71)	5.47 (3.03)	8.63 (3.00)
Competitive	6.87 (3.49)	10.27 (3.25)	6.88 (4.11)	9.24 (3.05)

Table 9 presents the averages and standard deviations of the total scores at the beginning and end of the instruction (assessment time) according to the methodology used and gender. The results of the ANOVA of the mixed design (Time of assessment/Methodology/Gender) indicate that there is no third-order interaction ($F = 1.06$; $p = 0.31$), nor second-order interaction between the time and the methodology ($F = 0.16$; $p = 0.69$) and methodology and gender ($F = 0.53$; $p = 0.47$), but between time and gender ($F = 7.76$; $p = 0.007$; $\eta^2 = 0.08$), in the sense that the increase in the score of boys is significantly higher than that of girls. The effects of the methodology are not significant ($F = 0.00$; $p = 0.996$), but there is a significant effect of the gender



($F = 14.25$; $p < 0.001$; $\eta^2 = 0.14$) and the time of assessment ($F = 74.69$; $p < 0.001$; $\eta^2 = 0.47$): boys have higher overall scores than girls in all cases and the total score after instruction is higher than the initial one.

Regardless of the approach utilized, all students improved following the use of both methodologies. Table 9 reveals that boys improved by 107.3 percent using the competitive technique and 68.5 percent using the cooperative methodology. Girls improved by 48.1 percent using the competitive technique and 71.3 percent using the cooperative methodology. These findings show that when the cooperative technique is used, both boys and girls progress similarly, but when the competitive methodology is used, boys improve much more than girls, who increase somewhat. With all of the mixed (Time of assessment/methodology/gender) design, there are no significant differences except when considering the time of execution and gender analysis, which means that in the case of launches without gender differences and in the case of the total score, the boys have improved more than the girls. The findings also show a tendency toward gender significance, implying that boys' scores are greater than girls' independent of technique or assessment period (initial or final).

Table 9. Descriptive indices of the launch scores in the two evaluated moments (initial / final) according to the learning methodology (competitive / cooperative) and the gender.

	Boys		Girls	
	Initial Mean (SD)	Final Mean (SD)	Initial Mean (SD)	Final Mean (SD)
Cooperatiu	81.20 (56.87)	136.80 (67.45)	50.53 (35.19)	86.58 (40.31)
Competitiu	66.72 (38.27)	138.28 (55.59)	60.59 (40.69)	89.71 (35.86)

DISCUSSION

The most notable criteria for the results obtained in this study is that they are consistent with the findings of Cenizo-Benjumea et al. (2019), who found motor variations associated to gender, in which, on motor tests, boys do better. In our study, we found that when a competitive and individualistic methodology is implemented, the differences are more noticeable, however when an active methodology such as

cooperative learning is employed, the disparities are less noticeable. This finding is in line with many findings reporting that education approaches based on cooperative learning promotes the reduction of either gender differences or inequalities (Ayers et al., 2020, Cañabate et al., 2019b, Cañabate et al., 2021b, Colomer et al., 2020).

On the other hand, we observed that the disparities between the first and final evaluations for boys and girls are not significant when it comes to implementing both competitive or cooperative learning activities. The findings reveal that students enhanced their learning outcomes in both techniques. In terms of the three aspects evaluated, there was a tendency for a significant difference between genders in terms of student involvement during the activities, as boys showed excellent involvement from the start of the study (76 % initial evaluation and 80 % final evaluation), whereas girls' involvement was divided between adequate, good, and excellent in the initial evaluation, where its involvement was divided between good and excellent (50% in each). These results emphasized that boys are more involved in tasks within a competitive methodology than within a cooperative methodology. Boys and girls expressed a moderate improvement when they were embedded in the cooperative methodology.

In terms of the qualitative components of the launch, the results demonstrate that the boys in the final evaluation performed at a higher level than the girls in both techniques, resulting in gender inequalities. The competitive technique produced superior findings for the male gender, as indicated by a greater percentage of experts in the categorized elements. In relation to the girls' gender, the improvement achieved between the initial and the final was also higher through the cooperative methodology, although it did not reach the levels of boys. In terms of the motor level attained, both the cooperative and competitive and individualistic approaches showed considerable advances in both genders, but both the cooperative and competitive methodology yields the best results for boys. As a result, regardless of the score, the sample using this technique displayed a higher number of final accurate scores (Du et al., 2017, Freitas et al., 2015, Jiménez-Díaz et al., 2015).



The significance of this study relies in the confirmation that competitive learning provides greater benefits in the learning process of the throwing skill than cooperative learning for boys. Cooperative learning is a methodological strategy for achieving better outcomes (Cañabate et al., 2021a, Derri et al., 2007), both in terms of task implication and qualitative and quantitative aspects at the motor level, as well as favoring, in a notable way, the improvement of the throwing skill. Cooperative learning provides opportunities to girls and boys to be embedded in a gender-equitable learning process, therefore proving that leaning outcomes are strongly linked to the definition and implementation of the educational approaches fostering gender equity (Johnson & Johnson, 2017). This research underlines the importance of the teacher accompanying students during active activities with instructions that assist the development of the five dimensions proposed by Johnson and Johnson (2017). The teacher encouraged kids to think before acting, to wait for their turn to speak or act, to share their doubts before an activity, to share what they know, and to use polite verbal and body language. The girls were more motivated to participate in cooperative activities because positive interdependence was triggered, i.e. the girls felt valued by others, but when the activities were competitive, the boys showed little or no interest. The girls improve through the cooperative manner because they seek joint methods, demonstrating growth in the development of interpersonal skills. Boys, on the other hand, primarily aimed to do for the sake of doing, attempting to try without regard for the necessity to improve interpersonal skills.

This study, but, has some limitations, such as the sample size of students, which should be expanded to include other primary school levels, since motor abilities may be dependent on age. Also, more longitudinal studies should be conducted to determine the effectiveness of cooperative learning in comparison to other teaching methodologies that foster gender equity. Finally, the results are constrained by the activity design, which should accommodate a greater variety of activities to account for the implications for students' learning when implementing physical activities through active instructional approaches.

CONCLUSIONS

Students in primary school were immersed in two different educational techniques with the goal of reducing gender inequities in the classroom and improving the capacity of a fundamental motor skill on an individual level. Students improved their basic motor skill of launching regardless of the educational style (competitive versus cooperative), with boys significantly boosting their ability when instruction was based on a competitive approach. Regardless of the technique or the assessment time, both boys and girls' findings exhibited a tendency toward gender significance, implying that boys' scores were greater than those attained by girls. Individually, cooperative learning was found to have an impact on both the task implication and the quantitative component of learning a motor skill, emphasizing the need of PE teachers in applying novel teaching techniques in primary schools.

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