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Traditional sporting games and play in physical education: Enhancing cultural diversity, emotional well-being, interpersonal relationships and intelligent decisions, volume II

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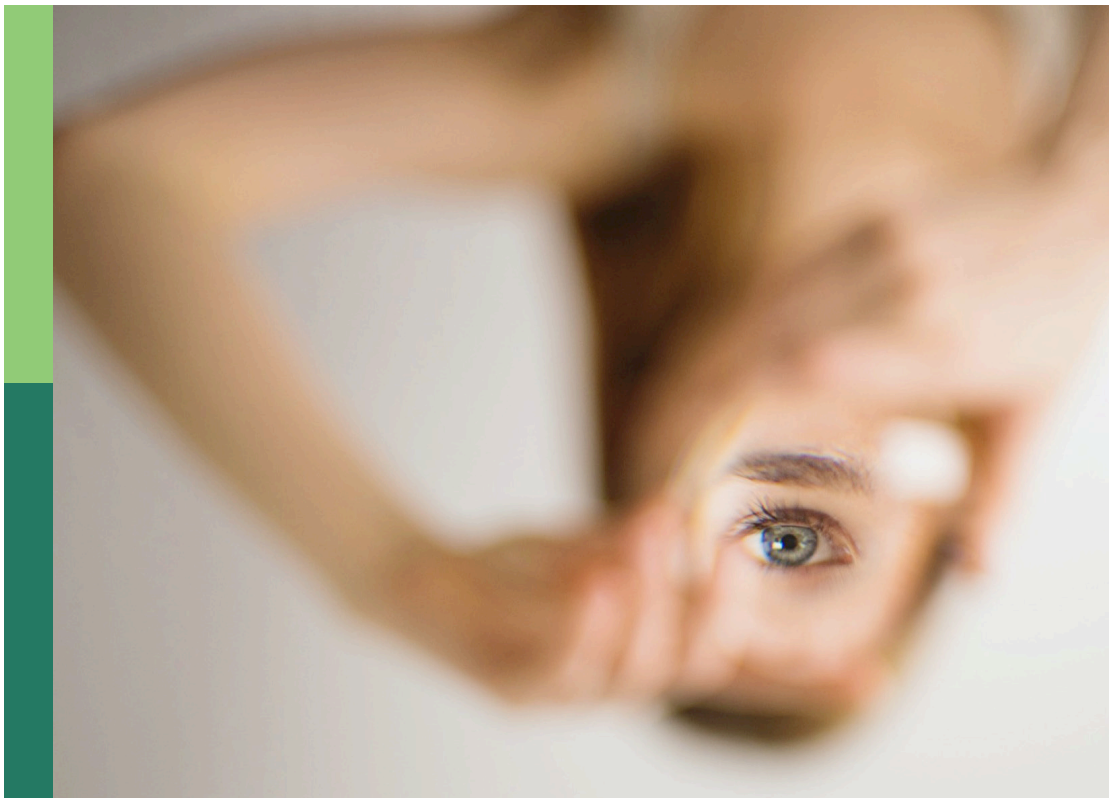

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Traditional sporting games and play in physical education: Enhancing cultural diversity, emotional well-being, interpersonal relationships and intelligent decisions, volume II

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The educational contribution of TSG and play from different perspectives

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Editorial: Traditional sporting games and play in physical education: enhancing cultural diversity, emotional well-being, interpersonal relationships and intelligent decisions, volume II

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KEYWORDS

traditional games and sports, emotional wellbeing, social inclusion, creativity, motor intelligence, educational contributions, motor praxeology, transdisciplinarity

Editorial on the Research Topic
Traditional sporting games and play in physical education: enhancing cultural diversity, emotional well-being, interpersonal relationships and intelligent decisions, volume II

Lavega-Burgués et al. of this Research Topic, have the pleasure of introducing the work corresponding to the "*Traditional sporting games and play in physical education: enhancing cultural diversity, emotional well-being, interpersonal relationships and intelligent decisions, volume II*".

This second volume consists of eleven articles that showcase the multifaceted perspective of TSG and play (Figure 1). From a thematic standpoint, this Research Topic explores the effects of TSG on affective, relational, cognitive, organic aspects, and their pedagogical application in physical education. Across various scientific disciplines, the contributions are rooted in motor praxeology, game theory, psychology, pedagogy, sociology, and the Teaching Games for Understanding approach.

In the first part, the *contribution of TSG to the social and emotional well-being* is directly addressed in the first three papers.

In the first article, Moya-Higueras et al. present the research titled "*Traditional Sporting Games as an emotional induction procedure*." This work, grounded in psychology and motor praxeology, demonstrates the contribution of TSG as a suitable procedure for inducing emotions and studying emotional states in a naturalistic manner, i.e., with ecological validity. Unlike other laboratory procedures, TSG serves as an authentic laboratory for relationships and emotions, where individuals express their emotional states profoundly.

FIGURE 1
Chapters volume II.

The second research by Dugas and Ben Ali, titled "*Reflection on TSG: the impact of bodily involvement on empathic dimensions*," investigates bodily engagement and the development of empathy in the practice of TSG. The authors draw on motor praxeology to show that TSG possess an internal logic that triggers the motor involvement of participants, with constant role changes that foster relational empathy within a rich network of social interactions.

This first part concludes with the research of Lavega-Burgués, titled "*Roles, relationships, and motor aggressions: keys to unveiling the emotions of a traditional sporting game*." The study reveals from a praxeological approach the emotional keys for promoting coexistence and motor aggressiveness education by using a TSG. The employed game confirms the originality of the rules that encompass the internal logic of TSG.

The second part of this volume addresses the *contribution of TSG in the context of social inclusion*. The first article is authored by March-Llanes et al. titled "*Chedoke-McMaster attitudes toward children with handicaps scale for traditional sporting games (CATCH-TSG): initial validation in 7 different languages in adult and young populations*." This manuscript is one of the collaborative efforts originating from the European Opportunity project to provide a validated questionnaire for examining the effects of TSG in transforming stereotypes related to individuals with intellectual disabilities.

Concurrently, Carter-Thuillier et al. undertake the intercultural research titled "*After-school sports programmes and social inclusion processes in culturally diverse contexts: results of an international multicase study*." It is evident that the use of TSG from various cultures can facilitate social inclusion processes and interpersonal relationships.

In the third section, two articles delve into the cognitive dimension of Traditional Sports and Games (TSG), highlighting the creativity and motor intelligence they promote. Oboeuf et al. present the study "*Relationships between empathy and creativity in collective games: a comparison between handball and sitting ball*." Drawing on motor praxeology, the authors compare the effects of a TSG and a sport on creativity and socio-motor empathy, associated with decision-making and cognitive and affective processes.

Subsequently, Schmidt and Ribas draw on motor praxeology to "*Identify and describe the sociomotor sub-roles and the Ludogram of Brazilian jiu-jitsu*." The article systematizes the decision-making units activated by the internal logic of this TSG, with the aim of facilitating the teaching of motor intelligence in Jiu-Jitsu.

The fourth part consists of four articles that highlight the educational contribution of TSG and play from different perspectives.

Hello et al. grounded in *games theory*, develop the study titled "*The concordance game: a simple tool to estimate breath-hold swimming performance and to teach dynamic apnea*." It demonstrates the interest of using TSG to improve organic, affective, and decisional aspects present in apnea motor actions.

Ribas et al. undertake the research titled "*How to understand sports and traditional games and how to apply it to physical education. on the "Goal of Game"*." The authors showcase the use of the "goal of game" concept to classify and promote educational applications of TSG.

Chow et al. present the study titled "*The effect of nonlinear pedagogy on the acquisition of game skills in a territorial game*." This study demonstrates the benefits of using nonlinear pedagogy, with a focus on Teaching Games for Understanding, to facilitate exploratory learning among students.

Finally, Houser and Kriellaars develop an enriched pedagogical approach with physical literacy. This contribution is aptly titled "'*Where was this when i was in Physical Education?' Physical literacy enriched pedagogy in a quality physical education context.*"

The *multidimensional perspective offered by this Research Topic* allows for a better understanding of the holistic contribution of physical education and sport. Traditional games, sports, modified games; interventions with schoolchildren, university students, or athletes; traditional pedagogies and innovative pedagogies have all revealed the treasure that accompanies physical activity and sport in general, and TSG in particular.

In conclusion, Lavega-Burgués et al. topic editors, of this second volume wish to express their gratitude to all the authors, editors, and reviewers for their magnificent work.

Following the publication of two Research Topic volumes on Traditional Games and Sports, we invite all researchers and educators to join the Worldwide Network of Teachers and Researchers in Traditional Games and Sports: https://jugaje.com/red-profesores/.

Alea Jacta Est!!!

Author contributions

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Traditional Sporting Games as an emotional induction procedure

Jorge Moya-Higueras[1,2], Jaume March-Llanes[1], Queralt Prat[3,4,5], Verónica Muñoz-Arroyave[3,4,5] and Pere Lavega-Burgués[3,4,5]*

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Experimental designs to induct emotional states have frequently used still procedures. However, more naturalistic methods of emotional induction by letting participants move and interact freely with other participants should be considered. Traditional Sporting Games (TSG) have the above-mentioned characteristics. The general aim of this study was to determine whether the different roles which allowed executing ambivalent interactions induced different emotional states in college students. We developed three studies with three paradoxical TSG (Sitting Ball Game, Four Corners Game, and Pitcher's Game). Before beginning to play, all the participants answered the Positive and Negative Affect Schedule (PANAS) in a mood version. After playing, participants were asked to report retrospectively the emotional state they were feeling in each role of the game, responding to the Self-Assessment Manikin, PANAS, and Games and Emotion Scale-II. Statistical analyses were performed by ANOVA, calculating corresponding effect sizes. Consistently, but specifically, in each game, roles still induced less positive and more negative emotions. Regarding the active roles, more positive and less negative emotions were kindled when the role allowed catching other players. On the contrary, when developing an active role that implied an increased likelihood of being caught, more negative and less positive emotions were experienced. We found some significant interaction effects between the moods and the role played before playing. To conclude, TSG could be an adequate procedure to induct emotional states and to study emotional conditions in a naturalistic way, showing ecological validity.

KEYWORDS

interpersonal relationships, motor praxeology, GES-II, ambivalent interactions, cognitive decisions

Introduction

In natural contexts, the human emotional experience is a cause and a consequence of social interaction (Hari et al., 2015; Gilam and Hendler, 2016). Although emotions and social information do not share the same brain regions, there is an overlap in most of the brain structures (Gilam and Hendler, 2016). So, understanding how social interactions relate to emotions is a key objective of modern neuroscience (Gilam and Hendler, 2016; Panksepp et al., 2017).

Scientists developed several procedures to induct emotional states (Lang et al., 1999, 2008; Marchewka et al., 2014; Trost et al., 2017; Fernández-Aguilar et al., 2018; Geethanjal et al., 2018). Visual stimulation using pictures (Lang et al., 1999, 2008; Marchewka et al., 2014) or videos (Fernández-Aguilar et al., 2018) has been commonly used. Another source of emotional activation is hearing, with music being the primary stimulus used (Trost et al., 2017; Geethanjal et al., 2018). These procedures have been usually used in research because they allow the use of modern neuroscientific procedures, such as fMRI (Gilam and Hendler, 2016). However, they need the person being evaluated to be passive. For example, picture stimulation procedures (Lang et al., 1999, 2008; Marchewka et al., 2014) require seeing a series of pictures of emotional content but without any possibility of interacting with the picture designed with the stimuli that appear in them. The same can be said about the video (Fernández-Aguilar et al., 2018) or music (Trost et al., 2017; Geethanjal et al., 2018) induction procedures. More modern tasks, such as games, require some cognitive decisions that elicit emotional states (Gilam and Hendler, 2016), though the participant has to be physically motionless.

Developing a procedure to induce emotions with instructions to control different kinds of experiences in experimental conditions would allow testing the emotional experience in a more natural way. Traditional Sporting Games (TSG) have the abovementioned characteristics. Depending on the type of motor relationship, the theory of motor action or motor praxeology (Parlebas, 2001) introduces the concept of sociomotor games for TSG where players interact with peers and or opponents (e.g., fighting games and team games). Sociomotor TSG have original rules as a result of local tradition. Accordingly, some of these games activate a system of relationships very different from that of classic collective sports (Parlebas et al., 2016).

Furthermore, some TSG, such as the Sitting Ball Game (SBG; Lavega et al., 2018), allow ambivalent interactions. An ambivalent interaction leads participants into ambiguous or paradoxical situations where each player is potentially an ally and an opponent of the other players at the same time (Parlebas et al., 2016). Against this backdrop of contradictory relationships, it is hard to predict the players' behavior because each individual will act following his or her subjective socio-affective preferences at different times during the game (Obœuf et al., 2008). So, TSG dynamics could be a way to assess social interactions.

To the best of our knowledge, no study with a rigorous methodology has been undertaken yet to examine whether TSG is apt to induce emotional states or not. So, we performed three studies, with different TSG, to test the hypothesis that TSG promotes a significant change in the emotional state after playing them. All the games used in this study activated ambivalent interactions.

Based on the effect sizes obtained from the study of Lavega et al. (2017), the sample size was calculated for the three studies by assuming the following parameters: a design of repeated measures, a level of significance of 95% CI, a minimum desired power of 80%, considering two-tailed hypotheses and, a minimally-interesting effect size of 0.3. Calculations were made with the G*power 3.1.9.7 software. Considering 10% of possible losses due to errors in the registry, the objective sample size calculation was 99 subjects.

Methodological overview

We designed three independent pre-post experiments to test whether TSG could promote a significant change in emotional experience after playing them. All the instruments regarding emotional experiences were assessed before and after participating in each TSG. According to the nature of the games, all the players acted in all possible roles. Games are adequately explained in each section. All the game sessions in the three studies lasted 8 min. In addition, all the TSG used were non-scoring games. During the game, participants constantly change their roles, and no rule marks the end of the game; the end of the game is marked by a standard duration of 8 min. This *ad-hoc* rule allowed us to compare better the emotional experiences through all the games. Finally, in the results section of each study, we first discuss the effects of playing the game and all the evoked emotions. Then, we focus on the different roles to test whether playing each role modulates the affective state.

Study 1: Sitting ball game

Materials and methods

Participants

We recruited 102 students (19 women and 83 men; aged between 18 and 26 years, $M_{age} = 20.08$ years, $SD = 2.07$) as participants from the University of Lleida. About 93.14% of the students had competitive sports experience (team sports). They were all first-year undergraduates pursuing a physical education and sports science degree. It should be noted that this study formed part of a training program for prospective physical education teachers, the aim of which was to raise their awareness about the relationship between motor intelligence and emotional intelligence. All students gave their active consent to participate. The research ethics committee of the University of Lleida approved the present study.

Instruments

One of the most used systems to assess emotional induction is the Self-Assessment Manikin (SAM; Lang et al., 2008; Moltó et al., 2013). However, Marchewka et al. (2014) explained that

SAM was not a consistent measure of emotion because different populations could associate different semantics to each scale's extremes, especially for the arousal one. Moreover, finding an analogous emotional response in different rating systems should indicate that the result is consistent and should be less affected by measurement bias. For these reasons, we decided to assess emotional responses with three different scales.

The SAM is the first test to measure the dimensions of pleasure, arousal, and dominance using a series of abstract figures horizontally arranged according to a nine-point scale. Pleasure ranged from a frowning to a smiling figure, and arousal spanned from a relaxed, sleepy to an excited, wide-eyed figure, showing an incremental explosion at the center, while dominance ranged from a very small to a huge figure. The present test is widely used as it is a pictographic representation of emotional states and has shown good validity and reliability (Bradley and Lang, 1994; Moltó et al., 2013).

Another test to assess the intensity of emotions experienced specifically during games is the Games and Emotion Scale-II (GES-II; Lavega-Burgués et al., 2017). Participants responded on a seven-point scale to the level of intensity experienced for each of the five basic emotions (joy, sadness, anger, rejection, and fear). A score of one meant they had hardly felt that emotion, while a score of seven was indicative of maximum intensity. The present test was specifically designed to assess emotional experiences when doing physical exercise, showing good psychometrical properties (Lavega-Burgués et al., 2017).

Finally, we assessed mood before the games and the emotional state after finishing them with the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988; Sandin et al., 1999). This measure consists of two ten-item mood scales to assess the Positive Affect (PA) and the Negative Affect (NA). Respondents were asked to rate the extent to which they experienced each particular emotion within a specified period with reference to a five-point scale (from 1 "very slightly or not at all" to 5 "very much"). We used the present questionnaire two times. The first one was to assess the mood state of the participants before the games' session, asking how they had felt "during the past 2 weeks." Second, we also requested the emotional state "when they were developing each role of the game" to assess the emotional state linked to the game experience. Validation studies performed in Spain and other countries showed that PANAS is valid and reliable to assess emotional states (Watson et al., 1988; Sandin et al., 1999; Ortuño-sierra et al., 2015).

Procedure

Before beginning the game, participants answered the mood version of the PANAS. Then, they played the Sitting Ball Game (SBG). This game is a TSG found in some European countries. The rules allow ambiguous or paradoxical relationships since each player can decide whether he/she wants to cooperate with or oppose the other participants. When players are free (alive role) and have the ball, they may decide to pass it to another player with a bounce (a collaborative action) or through the air (an opposition action), capturing the target player who must sit down on the ground (prisoner role; Lavega et al., 2018). If the prisoner players intercept the ball, they return to the alive role (Guillemard et al., 1984). Therefore, this game has three strategic roles: alive with the ball, alive without the ball, and prisoner (Lavega et al., 2018). During the game, each player has the autonomy to decide to collaborate or to oppose in any situation. Each decision is a relationship and also involves an emotional experience. The decisions and the emotional states of the participants in SBG put into action two interconnected realities: the internal logic of the game (system), which activates internal relations between the players, and the social actors (Scheve and Luede, 2005; Lavega et al., 2014). The adaptation of the players to internal logic leads each person to decide whether he/she is going to lead cooperative or oppositional relationships, i.e., improvise strategies associated with alliances and unpredictable betrayals. When the game ended, we asked the participants to rate their emotional state (with the SAM, GES, and PANAS) by retrospectively remembering how they felt when developing each role during the game.

Statistical analysis

After the initial descriptive exploration, the general linear model was carried out several times to evaluate the effect of role (within-subject factor), explaining the observed differences between dimensions of GES, SAM, and PANAS questionnaires. ANOVAs and ANCOVAs were applied to test factors and covariates introduced in each model. The analyses were performed with the SPSS package 24.0 (IBM Corp, 2016).

Results

ANOVAs revealed significant changes in all emotional outcomes [from $F_{Rejection-GES(2,202)} = 9.90$, $p < 0.001$, $\eta_p^2 = 0.16$ to $F_{Valence-SAM(2,202)} = 97.81$, $p < 0.001$, $\eta_p^2 = 0.66$] with the exception of the domination scale of the SAM [$F_{(2,202)} = 2.80$, $p = 0.066$, $\eta_p^2 = 0.05$]. After controlling the effect of mood before the game, the results remained the same [from $F_{Rejection-GES(2,198)} = 9.93$, $p < 0.001$, $\eta_p^2 = 0.17$ to $F_{Valence-SAM(2,198)} = 96.21$, $p < 0.001$, $\eta_p^2 = 0.66$]. Full results can be seen in Table 1.

When comparing the emotional scores reported within the different roles (see Table 1), playing alive with the ball generated more positive emotions than the other roles, measured with GES and with PANAS (compared to alive without the ball, $p < 0.001$, and prisoner, $p < 0.001$). Regarding negative emotions, GES revealed that the prisoner role elicited more sadness ($p < 0.001$), more anger ($p < 0.001$), and more rejection ($p <$

TABLE 1 Mean, standard deviations, ANCOVAs, and planned contrasts of Sitting Ball emotional induction game.

Sense co-variants	Alive with the ball (A)			Alive without the ball (B)			Prisoner (C)			F	η^2_p	Planned contrasts		
	M	CI		M	CI		M	CI				F (A vs. B)	η^2_p	F (A vs. C)	η^2_p
Joy/positive	5.12	4.84	5.40	3.82	3.55	4.10	2.85	2.55	3.16	82.18***	0.63	90.94***	0.48	160.23***	0.62
Sadness	1.32	1.20	1.45	1.78	1.56	2.01	3.01	2.68	3.34	51.78***	0.51	16.28***	0.14	104.47***	0.51
Fear	1.46	1.26	1.67	3.03	2.64	3.42	1.41	1.25	1.58	37.10***	0.43	61.80***	0.38	0.13	0.00
Anger	2.29	1.96	2.63	1.88	1.61	2.15	2.83	2.44	3.23	15.70***	0.24	6.24*	0.06	6.51*	0.06
Rejection	1.60	1.36	1.84	1.78	1.54	2.03	2.44	2.09	2.80	9.93***	0.17	1.69	0.02	17.94***	0.15
Neg Emo	6.68	6.07	7.28	8.48	7.68	929	9.70	8.70	10.69	17.24***	0.26	20.64***	0.17	34.07***	0.26
VAL	2.29	2.00	2.59	3.82	3.52	4.13	5.53	5.14	5.92	96.21***	0.66	94.34***	0.49	192.55***	0.66
INT	3.32	2.99	3.66	3.78	3.41	4.14	5.28	4.92	5.63	32.48***	0.40	7.19**	0.07	65.49***	0.40
DOM	5.76	5.33	6.18	5.29	4.90	5.69	5.56	5.16	5.96	2.80	0.05	4.72*	0.05	0.53	0.01
PA	35.21	33.80	36.62	31.01	29.57	32.45	27.15	25.56	28.73	64.44***	0.57	80.11***	0.45	122.69***	0.55
NA	15.28	14.46	16.09	19.82	18.49	21.16	18.06	16.96	19.16	35.82***	0.42	68.44***	0.41	31.70***	0.24

M, Estimated marginal means. Controlling for mood (PANAS) before playing the game.
*p < 0.05; **p < 0.01; ***p < 0.001.
η^2_p < 0.06, small effect size; 0.06 < η^2_p < 0.14, medium effect size; η^2_p > 0.14, large effect size.

0.001) than any other role. On the contrary, when players were alive without the ball, they experienced more fear than in any other situation ($p < 0.001$). The general GES scale of negative emotions showed a higher score when in the prisoner role ($p < 0.001$), while the negative affect scale (PANAS) showed a higher score when participants were alive without the ball. The results of the SAM scale were in accordance with the GES, reporting higher negative valence ($p < 0.001$) and higher intensity ($p < 0.001$) when playing the prisoner role.

Study 2: Four corners game

Materials and methods

Participants

We recruited 119 students (21 women and 98 men; aged between 18 and 28 years, $M_{age} = 21.01$ years, $SD = 2.27$) as participants from the University of Lleida. About 77.7% of the students had competitive sports experience (team sports). They were all 1st-year undergraduates pursuing a physical education and sports science degree. It should be noted that this study formed part of a training program for prospective physical education teachers, the aim of which was to raise their awareness about the relationship between motor intelligence and emotional intelligence. All students gave their active consent to participate. The research ethics committee of the University of Lleida approved the present study.

Instruments

The instruments of the present study were the same as study 1.

Procedure

Consistent with study 1, we administered the PANAS mood version to the participants before they began to play the Four Corners Game. This TSG is found in many European and American countries. This game is played in a square space of about 5 × 5 m. Five players can participate in the game, of which one is located in the center (center role) and the rest in each of the four corners (corner role). The players in the corners try to change corners at their will, avoiding the player in the center arriving before them. The player who is left without a corner goes on to occupy the center. The rules allow the existence of ambiguous or paradoxical relationships since each player can decide whether he/she wants to cooperate or oppose the participants of the other corners. In this game two players cooperate when they agree to exchange their corners, synchronizing the actions. Two players oppose each other when, after deciding to go out to exchange the position, one of them shows that he/she is going to go out or goes out a few meters and then returns to his/her corner. In that circumstance, the partner

of another corner is in a situation of ambivalent relation that the center role player takes advantage of to occupy that corner. Once all the participants ended playing, the SAM, GES, and PANAS were administered retrospectively while the participants were asked to request to remember how they felt when developing each role during the game.

Statistical analysis

A similar strategy was applied as used in study 1.

Results

The ANOVAs revealed significant changes in all emotional outcomes [from $F_{Dominance-SAM(1,87)} = 6.66$, $p = 0.12$, $\eta_p^2 = 0.07$ to $F_{Positiveemotion-GES(1,87)} = 114.52$, $p < 0.001$, $\eta_p^2 = 0.57$] with the exception of the intensity scale of the SAM [$F_{(1,87)} = 2.48$, $p = 0.112$, $\eta_p^2 = 0.03$]. After controlling the effect of mood before the game, the intensity scale of the SAM remained non-significant [$F_{(1,85)} = 2.58$, $p = 0.112$, $\eta_p^2 = 0.03$] and the fear scale of the GES became non-significant [$F_{(1,85)} = 0.90$, $p = 0.345$, $\eta_p^2 = 0.03$] while the other results remained significant. Full results are shown in Table 2.

In this game, each participant could be at the corner or the center. As the game has only two roles, the means could be directly compared through the significant ANOVA results. Hence, the corner role showed more positive emotions and fewer negative emotions than the center role.

In the robust analysis, mood was introduced as a factor in the ANOVAs to control its effect. In this game, some interactions were found between the initial mood and the game's role in different emotions (see Figure 1). For example, participants with higher negative affect (mood) experienced more positive emotions when they were at the center than when they were at the corner. On the other side, participants with higher positive affect felt more negative emotion and, especially, higher sadness when they were at the center than when they were at the corner.

Study 3: Pitcher's game (elbow game)

Materials and methods

Participants

We recruited 129 students (35 women and 94 men; aged between 18 and 27 years, $M_{age} = 20.99$ years, $SD = 2.23$) as participants from the University of Lleida. About 78.29% of the students had competitive sports experience (team sports). They were all 1st-year undergraduates pursuing a physical education and sports science degree. It should be noted that this study formed part of a training program for prospective

TABLE 2 Mean, standard deviations, ANCOVAs, and planned contrasts of Four Corners emotional induction game.

Sense co-variants	Corner (A)			Center (B)			F	η_p^2	Interaction with PA (mood)		Interaction with NA (mood)	
	M	CI		M	CI				F	η_p^2	F	η_p^2
Joy/positive*cov	4.55	4.26	4.83	2.82	2.54	3.10	126.224***	0.60	0.95	0.01	10.49**	0.11
Sadness*amb cov	1.49	1.31	1.67	2.31	2.02	2.59	36.42***	0.30	14.57***	0.15	0.34	0.00
Fear*amb cov	1.77	1.52	2.03	1.64	1.42	1.85	0.90	0.10	0.37	0.00	3.74	0.04
Anger*amb cov	1.60	1.37	1.83	2.14	1.84	2.43	14.71***	0.15	2.23	0.03	0.91	0.01
Rejection*amb cov	1.44	1.29	1.60	2.10	1.81	2.40	19.04***	0.18	0.12	0.00	1.31	0.02
Neg Emotion*cov	6.31	5.79	6.82	8.18	7.39	8.97	30.79***	0.27	6.55*	0.07	0.50	0.01
VAL*amb cov	2.65	2.34	2.95	4.64	4.22	5.05	83.88***	0.50	3.91	0.04	1.44	0.02
INT*amb cov	4.02	3.67	4.38	3.72	3.30	4.13	2.58	0.03	5.21*	0.06	0.20	0.00
DOM*amb cov	5.65	5.28	6.01	5.13	4.75	5.51	6.81*	0.07	3.62	0.04	0.16	0.00
PA*amb cov	30.27	29.00	31.54	27.68	26.20	29.16	28.05***	0.25	4.04*	0.05	0.80	0.01
NA*amb cov	16.02	15.14	16.91	19.28	18.08	20.49	41.21***	0.33	4.30*	0.05	2.40	0.03

M, Estimated marginal means; PA, Positive affect; NA, Negative affect.
*p < 0.05; **p < 0.01; ***p < 0.001.
$\eta_p^2 < 0.06$, small effect size; $0.06 < \eta_p^2 < 0.14$, medium effect size; $\eta_p^2 > 0.14$, large effect size.

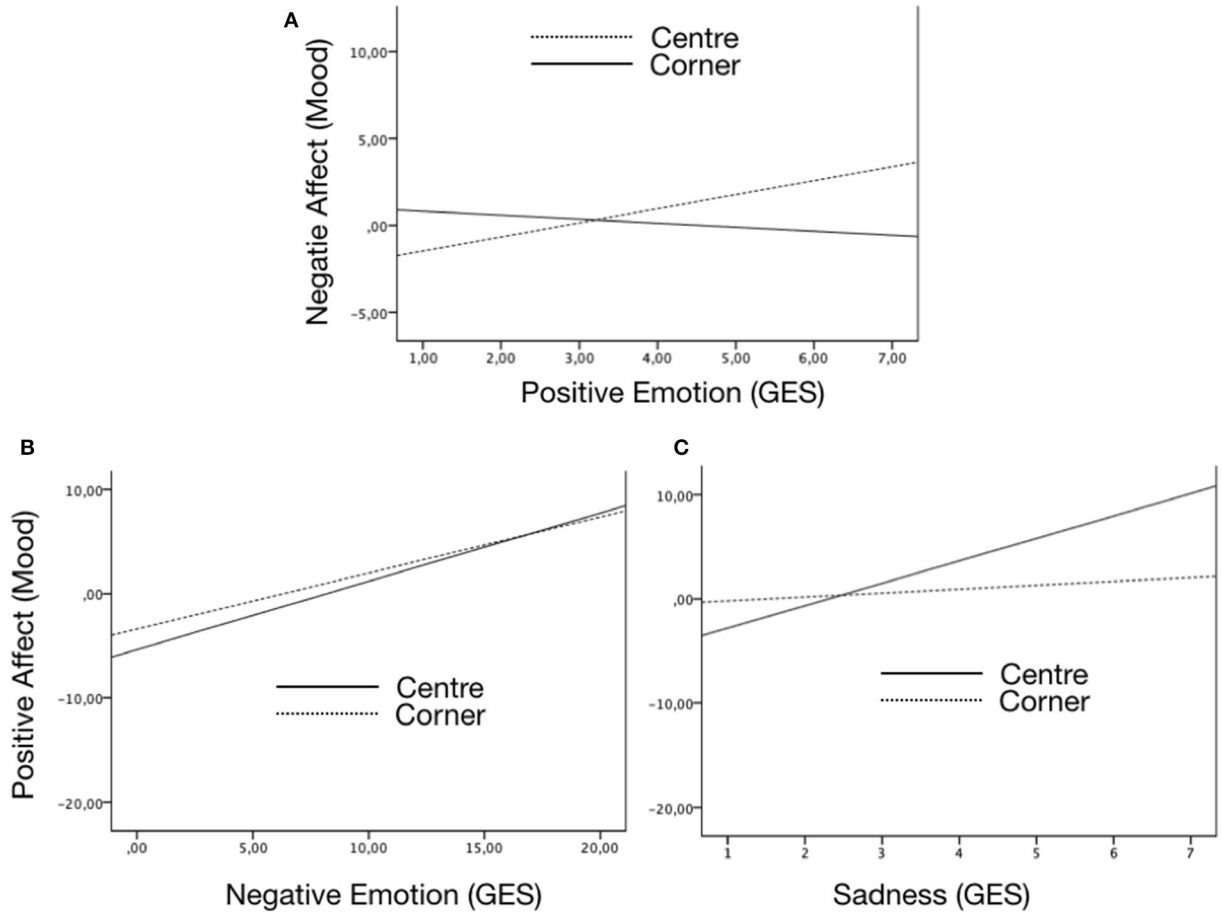

FIGURE 1
Significant interactions between emotions induced (by the GES) and mood (PANAS) in the Four Corner game. **(A)** Positive Emotion (GES) and Negative Affect (PANAS). **(B)** Negative Emotion (GES) and Positive Affect (PANAS). **(C)** Sadness (GES) and Positive Affect (PANAS).

physical education teachers, the aim of which was to raise their awareness about the relationship between motor intelligence and emotional intelligence. All students gave their active consent to participate. The research ethics committee of the University of Lleida approved the present study.

Instruments

The instruments of the present study were the same as studies 1 and 2.

Procedure

We administered the PANAS mood version to the participants before they began playing the Pitcher's Game. This is a TSG that has been played since the middle ages in different European countries. The players are placed in pairs joined by one arm. Each pair is separated from the other pairs at about 2 m. All pairs delimit the playing field that represents a big circle. These players share the role of the pitcher. There are also two other players, with the roles of Cat and Rat. The Cat chases the Rat, and if he/she manages to touch the Rat, the roles are exchanged. The Rat moves where it wants, either inside the circle or behind the pitchers. When the Rat joins a person in the pitcher role, the person on the other side of the pitcher must abandon the role of a Pitcher and go out assuming the Rat role. In this game, ambivalent relationships arise from the moment a Rat player decides which Pitcher is going to become the next Rat (opposition relationship) by joining his/her partner or allowing him/her to continue in the role of a Pitcher (cooperation relationship) by taking the arm of that player. In this game, the changes in the roles derive from contradictory relations of cooperation and opposition without any apparent logic. Similar to previous studies, participants answered the SAM, GES, and PANAS, recollecting how they felt when developing each role during the game.

Statistical analysis

A similar strategy was applied as used in studies 1 and 2.

TABLE 3 Mean, standard deviations, ANCOVAs, and planned contrasts of Pitchers' emotional induction game.

Sense co-variants	Cat (A)		Rat (B)		Pitcher (P)		F	η_p^2	Planned contrasts			
	M	CI	M	CI	M	CI			F (A vs. B)	η_p^2	F (A vs. C)	η_p^2
Amb co-variants												
Joy/positive	4.11	3.79	4.43	4.66	4.38	4.93	4.50	4.23	4.78	5.11**	0.08	10.19**	0.08	4.14*	0.04
Sadness	1.83	1.59	2.07	1.39	1.22	1.56	1.37	1.23	1.51	8.32***	0.13	13.51***	0.11	24.80***	0.12
Fear[a]	1.59	1.38	1.79	2.58	2.25	2.91	2.24	1.95	2.53	19.73***	0.26	34.51***	0.23	21.70***	0.16
Anger	2.04	1.76	2.31	1.41	1.25	1.57	1.31	1.17	1.44	19.15***	0.25	31.72***	0.22	36.38***	0.24
Rejection	1.70	1.49	1.92	1.44	1.24	1.63	1.42	1.24	1.60	3.11*	0.05	4.96*	0.04	4.70*	0.04
Neg Emotion	7.17	6.47	7.87	6.82	6.21	7.43	6.35	5.81	6.88	3.65*	0.06	1.28	0.01	6.69*	0.06
VAL	3.59	3.23	3.95	3.02	2.68	3.35	3.19	2.86	3.51	5.77**	0.09	11.55**	0.09	3.41	0.03
INT	3.42	3.08	3.75	2.93	2.55	3.31	4.94	4.59	5.30	28.13***	0.33	18.66***	0.14	36.50***	0.24
DOM	5.31	4.95	5.68	5.17	4.77	5.58	5.80	5.43	6.18	3.93*	0.07	0.82	0.01	5.98*	0.05
PA	33.72	32.57	34.88	35.50	34.27	36.72	28.09	26.75	29.44	42.29***	0.45	10.95**	0.10	58.84***	0.36
NA	18.37	17.26	19.49	19.77	18.50	21.03	17.44	16.42	18.47	12.44***	0.18	11.60**	0.09	4.89*	0.04

M, Estimated marginal means.
[a]Interaction between the positive affect mood factor and the roles' factor.
*p < 0.05; **p < 0.01; ***p < 0.001.
$\eta_p^2 < 0.06$, small effect size; $0.06 < \eta_p^2 < 0.14$, medium effect size; $\eta_p^2 > 0.14$, large effect size.

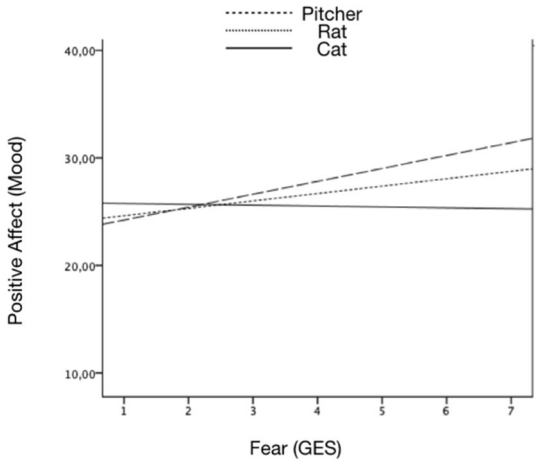

FIGURE 2
Significant interactions between emotions induced (by the GES) and mood (PANAS) in the Pitcher game.

Results

In this game, significant results were found in all emotional outcomes [from $F_{Rejection-GES(2,232)} = 3.14$, $p = 0.037$, $\eta_p^2 = 0.05$ to $F_{PositiveAffect-PANAS(2,232)} = 43.15$, $p < 0.001$, $\eta_p^2 = 0.45$]. All results remained significant after controlling the effect of mood [from $F_{Rejection-GES(2,208)} = 3.11$, $p = 0.048$, $\eta_p^2 = 0.05$ to $F_{PositiveAffect-PANAS(2,208)} = 42.29$, $p < 0.001$, $\eta_p^2 = 0.45$]. Full results can be seen in Table 3.

Post-hoc analyses of the three roles (see Table 3) revealed that the Rat role induced more positive emotional states than the Cat role (Joy/positive$_{SAM}$, $p = 0.002$, Valence$_{SAM}$, $p = 0.001$, Positive Affect$_{PANAS}$, $p = 0.001$). Regarding negative emotions, the results are not so consistent comparing different roles. While we found higher mean scores on Negative Affect$_{PANAS}$ ($p = 0.001$) for the Rat role, the Negative Emotion scale of the GES revealed higher scores (but not significant) when assuming the Cat role ($p = 0.37$). The valence scale of the SAM was more similar to the GES than to the PANAS scale. Focusing on specific emotions, participants showed higher levels of fear when in the Rat role ($p = <0.001$) but higher levels of sadness ($p = <0.001$), anger ($p = <0.001$), and rejection ($p = 0.028$) when in the Cat role.

Finally, in line with the Four Corners Game, we found a significant interaction between mood and role factors. Specifically, those participants with positive moods experienced the most fear in the Pitcher role and the least in the Cat role (see Figure 2).

General conclusion

The main objective of the present study was to examine whether playing TSG with ambivalent interactions generates different emotions or not. Ambivalent TSG means that each player could change the role he/she is developing according to the game's rules but in an unpredictable way because of the interaction with others (Parlebas et al., 2016).

According to the results of the studies performed with three different TSGs, the hypothesis of the study was confirmed. Moreover, to test the hypothesis, we assessed emotional states with three different measures (SAM, PANAS state, and GES). The same kind of emotional state was replicated across the different measures after controlling the effect of mood at the baseline. We also found some significant interaction effects between moods before beginning to play TSGs and reported emotions with specific roles. These results showed the importance of controlling the effect of the previous mood in emotion induction procedures as past studies showed (Fernández-Aguilar et al., 2018). In addition, the present results are in line with previous initiatives of capturing emotional changes while playing TSG (Lecrosiey, 2017). In this study, the authors showed that facial expressions changed when players acted in different roles. While the study of Lecrosiey (2017) focused on directly monitoring the emotional states while playing, we emphasized the subjective emotional experience. Both studies point out that, when playing TSG, different roles derive specific emotional experiences.

As we used the SAM system, we could compare the magnitude of activation of TSG with other emotion induction procedures. Valence and intensity scores were lower in the present study than using pictures (Marchewka et al., 2014), though it was similar to using films (Fernández-Aguilar et al., 2018). Marchewka et al. (2014) explained that they used different descriptions for the scales' extremes, though the original studies also showed higher valence and arousal scores with pictures than what we found with TSG (Moltó et al., 1999, 2013). On the other hand, there are significant differences in our procedure compared to using other kinds of stimuli. In the present study, in all the TSG, participants played an entire match, and then, they estimated their emotions when performing each possible role, retrospectively. When using pictures or films (Moltó et al., 1999; Marchewka et al., 2014; Fernández-Aguilar et al., 2018), participants were questioned immediately after watching the stimuli. Hence, we hypothesize that if we could stop the game and ask the participants when they have finished each role, we could find higher valence and intensity ratings. However, this procedure would completely change the dynamics of the game, making it impossible to pursue an experimental design like the present one. Nevertheless, future studies could focus on assessing emotional responses more immediately when using TSG. One possible solution could be incorporating physiological recordings. The main problem with this suggestion is that participants must move to play TSG. When registering physiological responses in lab settings, people are calm and relaxed, and they are usually explicitly incited to not move (Levenson, 2014). Eliciting emotions with TSG is incompatible with staying calm, relaxed, and static. Although wearable wireless biosensors are still in their first steps (Salim and Lim, 2019), future studies of emotion induction in natural settings, such as playing TSG, could use these kinds of instruments.

As the present study focused on basic emotions, the specific feelings derived from the different roles in the games are in line with different theoretic emotion models (Ekman and Cordaro, 2011; Izard, 2011; Levenson, 2011; Panksepp and Watt, 2011). For example, in the SBG (Guillemard et al., 1984; Lavega et al., 2018), players felt more fear when they were alive without the ball than in any other role, while they felt more sadness when they were prisoners than in any other role. In the SBG, when a player is free but he/she has not got the ball (alive without the ball), there is a chance of receiving the ball through the air. If the player does not intercept the ball and the ball touches him/her, then he/she becomes a prisoner. As a prisoner, players do not interact in the game because they are forced to sit down unless they intercept the ball (which is very difficult). Hence, as fear becomes evident when we detect a threat (Ekman and Cordaro, 2011), players in the alive without the ball role are threatened by the possibility of a change in their status to a prisoner role. Similar to when we are overcome with sadness when we lose anything (Ekman and Cordaro, 2011), the players playing the prisoner role, who have lost the chance of playing actively in the game, in this game are also overcome with sadness. Similar results were found in the other two games.

We believe that these results could be different if we study secondary or social emotions. All the basic emotion models conclude that one difference between basic and non-basic emotions is the magnitude of appraisal (Tracy and Randles, 2011). While automatic appraisals characterize basic emotions, non-basic emotions depend more on elaborated ones. The concept of appraisal could be understood as to how a person interprets the stimulus or situation (Lazarus, 1991; Phillips et al., 2003). Hence, it will depend on how players interpret what is occurring during the game to feel one emotion or another. For example, in the SBG, if a player feels that two other players are always collaborating between them but opposing him/her, the player could feel jealous of not being included in the collaborating strategy of the other two players. Alternatively, the player could feel hate because the other two players are against him/her. It could be even possible to feel both emotions at the same time. Nevertheless, these are hypothetical results that we have not studied in the present research. In addition to retrospectively asking for the emotion felt in each role, we could

ask for the general appraisal of the situation. So, in future studies, we expect to develop this perspective.

The present study has some limitations. An intrinsic characteristic of TSG is in itself a limitation, i.e., when participants are playing continuously while adopting different roles, we could not stop the game each time they assumed a new role to ask them about the emotion they were feeling in each role. The assessment of the emotion induction was performed retrospectively after completing the game. In more usual procedures, such as picture or movie induction, the stimuli are presented, and shortly thereafter (milliseconds or seconds), a subjective response is requested (Moltó et al., 1999; Marchewka et al., 2014; Fernández-Aguilar et al., 2018). Another limitation was that all the participants were undergraduate students from physical education and sports majors. It is possible that the results might be different with students of other degrees or with young adults of the general population. Besides, Fernández-Aguilar et al. (2018) found significant age differences in mood induction procedures. So, it could be expected that older people playing TSG would report different emotional states than younger participants. Finally, though the sample size was adequate in the last two studies, the sample size in the first study was limited. It would be advisable to replicate the present study with bigger samples.

Thus, to conclude, we presented three studies with different TSG. Consistently and according to the internal logic of the game, as players developed each role, they felt different emotional states. The results were mostly consistent with three different measures of emotional states. So, we propose to use TSG in future studies to assess emotional responses and states in a more naturalistic fashion.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee of the University of Lleida. The patients/participants provided their written informed consent to participate in this study.

Author contributions

JM-H and JM-L led the writing of the manuscript and the statistical analyses. QP and VM-A helped with finishing the manuscript, reviewing the different drafts, and in the execution of the project. PL-B coordinated the tea, designed the study, and was in charge of collecting the data. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Reflection on traditional sporting games: the impact of bodily involvement on empathic dimensions

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The aim of this study was to investigate bodily engagement and involvement in traditional sporting games (TSGs), with a focus on the development of empathy. Even though the current research on empathy has been focused on its emotional component, the name "empathy" alludes to a considerably more profound dimension than emotional engagement. Empathy refers to the ability to perceive another person's private life through the exchange of contextual factors provided through interactive sports activities. In this study, based on real-world experiences, it has been demonstrated that traditional sporting games stimulate, preserve, or reveal empathic capacities in several ways. Games can show and sustain the full potential of empathic dispositions if they are present at a young age. Moreover, by examining empathy through the prism of a TSG, we recognized them as a source of relational empathy and feelings developed to various degrees by direct involvement. As a result, we may define empathy as an integrated pedagogy that can be more successfully conducted through TSGs which are multifaceted because of their internal and external logic systems. Essentially, the hypotheses discussed in this study allow us to postulate that the physical gaming involvement of players, such as role changes, influences the individual's empathic dimensions. Furthermore, the characteristics of traditional sporting game interaction networks may serve as a source of encouragement or inspiration for a wide range of games (theatrical, social, etc.).

KEYWORDS

empathic dimensions, internal logic motricity, decision-making, interaction, traditional sporting games

1. Introduction

Throughout history, the definition of "gaming" has shifted from potentially educational or social activities to undesirable or futile activities reflecting deviant behaviors (Brougère, 1995, 2012). Previous centuries of research have shown that games, even so-called sporting games, were the target of criticism and disrespect (Parlebas, 1975, 1995; During, 1981; Harouel, 2011). As a result, many academic researchers could not see games as a worthy topic of study, which is why there was considerable interest in other topics such as emotion or ideology. However, as Parlebas and Boutin (2022) highlighted in their study, some well-known scientists preferred studying games despite their appearances, misunderstandings, and the controversies surrounding them. Several interesting studies have been published, including Jérôme Cardan's "Hazard Games" (Morley, 1854), Von Neumann's "Social Games" (von Neumann and

Morgenstern, 2004), Bernoulli's (1713) "Palm Game and Mathematical Expectation," Borel's "Poker Game" (Ferguson, 2003), the famous works of Caillois (1955) and Winnicott (1971) about games and reality. Within the cited categories of investigations, this study focuses on traditional sporting games (TSGs).

Since TSGs are non-institutional sporting events, undoubtedly, they allow for outstanding interactional frameworks (Parlebas, 1981, 2020; Dugas, 2004). These codified ludomotor activities may reveal their merits through the original physical interactions in which we live with ourselves and others (partners or opponents), which may stimulate and strengthen all players' empathetic behavior. Indeed, physical play could promote the development of empathy by encouraging "daring" and "feeling the other." Empathy is a necessary component of human relationships and social existence. It is multidimensional, involving "affective empathy, cognitive empathy, concern for others, emotional regulation, and self-awareness" (Decety, 2020). As a result, it is critical to distinguish all empathy factors from other human qualities. Thus, one point in common between the concepts of "empathy" and "game" is their amorphous and non-conformist nature. This peculiarity has resulted in a demultiplication of recent academic works incorporating new points of view (Attigui and Cukier, 2019). Tisseron and Bass (2011) defines empathy as a necessary component and as an unavoidable cement of human relationships.

Professionals in the workforce, care, management, and education stick to new ideas like "care," "wellbeing, and "professional empathy" in the face of "ill-being" (Dugas et al., 2020); therefore, a large amount of research has been focused on the "development of psychosocial skills" (OMS, 1997), which is essential to any social life. Furthermore, the recent COVID-19 pandemic has aggravated this phenomenon at the heart of society, businesses, and schools (Dugas et al., 2020) by slowing the emergence of a new awareness of a world in crisis (Rifkin, 2011). As a result, a deep understanding of the required coupling between "person and environment" is necessary, along with a meticulous examination of the structures through which the players move.

The spaces where we live, learn, and work are more than just decorations (Moser, 2009); they shape our attitudes and actions (Fischer, 2011). Thus, the relationship between "player(s) and game structures" is therefore interesting to investigate, since it may lead us to question and analyze how TSGs (Lavega et al., 2014; Lavega-Burgués et al., 2020; Parlebas, 2020) may act as a lever for relational empathy. Furthermore, it also led us to question how it could function as an operational and dynamic revealer of empathy built through playful interactions. In this context, games may be an effective means of cultivating empathy in individuals and groups (Decety and Cowell, 2014).

This study examines the relationship between "player(s)/game structures" and empathy through games with interdependent ludomotor interactions (Dugas, 2011a). It offers an opportunity to enhance our knowledge concerning the concepts of "empathy" and "traditional sporting games" through the prism of motor praxeology and a systemic approach (Parlebas, 1981, 1999). It also analyzes several field studies associated with TSG to feed our reflection that these sporting games are likely to stimulate, maintain, or reveal in various ways the potentialities and empathic capacities of those players (Lavega et al., 2014; Lavega-Burgués et al., 2020; Parlebas, 2020). Finally, the impact of bodily involvement can inspire other forms of games to stimulate empathetic awakening.

Throughout this study, we attempted to investigate through examples how a TSG, as a codified ludomotor activity, might reveal all its attraction through the original physical interactions in which we, that is, ourselves and others (partners or opponents), live. The main aim of this study was to unravel how gaming stimulates and strengthens the empathetic conduct of players through physical involvement. We also analyzed the question "how could the internal logic of a game affect all aspects of the players and enhance their emotional contact and resonance (Zanna, 2015b; Zanna and Jarry, 2019) by mobilizing their empathetic conduct and availability?"

Indeed, to encourage the development of empathy by "daring" and "feeling the other" through physical play, we also put forward that a complete understanding of the prerequisite coupling between "person and environment" is required. Therefore, a meticulous examination of the structures through which the players move seems to be crucial (Dugas, 2011b; Dugas and Loyer, 2018; Parlebas, 2020), because while there is undeniably a "Me" in "Game," there is also a "Game" in "Me" (Parlebas, 1975).

2. Systemic approach: differences between sporting games and other games

Let's start with a study of ludomotor activities that need medium to fine motor skills (such as TSG, leisure games, and competitive games) because they are commonly practiced (Parlebas, 1981). These activities are opposed to motor skills at work (ergomotricity) and games devoid of motor relevance such as cognitive games (or board games). In this regard, Pierre Parlebas considers that, in games of chess, bridge, or scrabble, "[…] relevance is not driving but combinatorial and/or symbolic." These activities are therefore not sporting games according to the point of view adopted.

In addition, various sorts of games (Berry, 2012) have appeared in modern societies, such as computer games, serious games, and other escape games that need motricity to some level. Thus, the controller held in the hand can replace the player in tennis or a team in a football match. However, it is inconceivable to confuse a tennis controller-handling player with a racket-handling athlete (Bordes et al., 2007).

Motor abilities, in summary, might be actual, mimicked, or even virtual, since they are becoming increasingly associated with virtual reality (VR) or augmented reality as technology advances (Tassinari et al., 2021). In addition, it is possible to project oneself into a world where players remain on the edge of ludomotor reality, for example, using artificial sensory systems (Ben Ali et al., 2018, 2020a) of the main human senses (such as sight, hearing, and touch). However, this ludomotricity does not combine (yet) the physical and biological constitutions of the sporting factors and has no real motricity (Delaunay, 1981).

The space of ludomotor practices extends from unorganized and free activities to formal and institutionalized activities, called "sports" by Parlebas (2010). Between the two poles of this ludomotor chain, we found games that are not under the supervision of a sports federation. However, these physical games outside institutions are codified and endowed with rules shaping the practitioner's

confrontation with the human and/or physical environment. Among these rich and varied practices, we found TSGs (Dugas and During, 2006).

Faced with this proliferation of ludomotor practices, this article focuses, as mentioned above, on sporting games, defined as a "codified motor situation of confrontation, called games or sports by social authorities".

A sporting game is defined by its system of rules that determines its internal logic (Parlebas, 1999). Sporting games are thus accomplished based on a ludic contract within which motor practice is subject to a system of rules that makes it meaningful. From then on, the sporting game is at the crossroads of collective rules and individual choices, and once the latter are subject to the former, the game acquires the role of participating in culture and education. Moreover, this ludic context allows many types of ludomotor interactions that do not take place in a social vacuum. The behaviors of the players are thus placed at the heart of the system in an inseparable relationship with the context of action, having original problems to solve. It is, therefore, recognized as a "praxeological" system (Parlebas, 1986) before understanding the dynamics of empathy that we are going to explore in this study. In our view, this systemic approach is composed of three interacting "systemic entities', as shown in Figure 1.

In 1976, Parlebas (1976, 2020) stated that "behind the superficial disorder that is all the rage in traditional games, there is an in-depth order in there too." This remark recalled two inextricably linked, interconnected, and fundamental logics of the environments in which the actors' conduct occures. Parlebas defines them as universals," since these rules or subordinate objective systems serve as a basis for the "praxic exchanges" observed in all games and sports.

- An "internal logic" to the situation, presenting a system of constraints and possibilities resulting from the rules that are part of the playful action of the players and that take into account the relationship of the intervener to the physical environment and to the other characteristics such as objects, time, space, and the scoring system (if present). This first logic is defined by the "system of relevant features of a motor situation and the consequences it entails in the performance of the corresponding motor action" (Parlebas, 1999).
- An "external logic" divided into two systemic variables: the characteristics of the actors (e.g., age, sex/gender, otherness, personality, motivation, mobilization, and interindividual relations) and the organizational characteristics (e.g., social factor, socioeconomic, cultural, political, institutional, or social spaces). Moreover, many other factors can also intervene within the external logic (e.g., institutions, cultural belonging, group dynamics, relational aspects, the motor intelligence of the individual, and their empathy capacities).

Each sporting game stages its own universal steps, leading to extremely varied specific behaviors, extraordinarily rich in relational consequences. The "universals" of team sports show a great relational clarity that makes them a reference of undeniable interest. For example, team sports only accept symmetrical (football) or asymmetrical (baseball) duels between two teams with stable relations between partners and adversaries, while the salient rules of TSG allows us to compare the variety of motor interactions allowed by the networks of exchanges. This category of games will be of particular interest to us as a lever for empathy.

3. Traditional sporting games as a backdrop for an empathic plea

The desire to oppose, win, or dominate informs us about the cultural background of civilizations. Indeed, not all games are strictly competitive in every society (Lévi-Strauss, 1962). Many sporting games are unconventional in their relationships with machines, equipment, and space, especially in their relationship with others (e.g., relational structures such as "each for themselves," "one team against others," "one against all," "paradoxical games," "determined games," "rite games," etc.).

Thus, unlike team sports (e.g., football, handball, volleyball, rugby, and basketball), many traditional collective sporting games and some situations of opposition do not systematically seek victory and

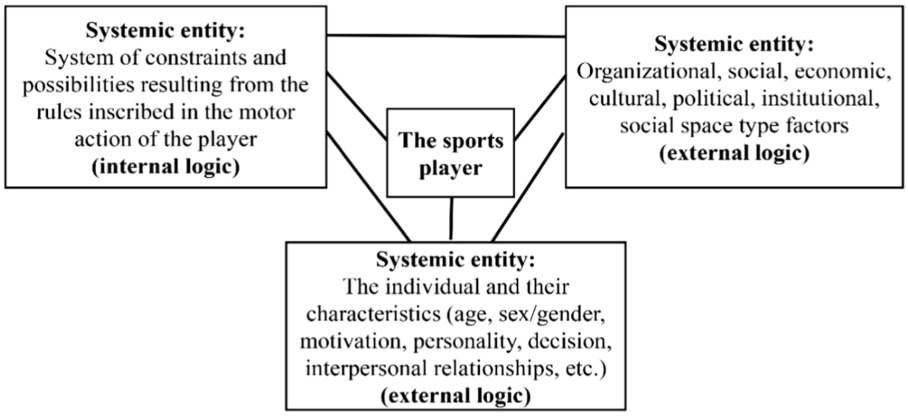

FIGURE 1
Systemic approach to internal and external logics to make player behavior intelligible; adaptation of the diagram from *L'homme Systémique* (Dugas, 2011b).

domination over others. Thus, relationships among players can be stable or unstable (Parlebas, 2020). Players can change teams or alliances if there are no predefined teams.

Indeed, the relational network in these games is permutable and dictated by the rules of the game. Moreover, with each winning interaction of one of the players, the players change teams or roles. The presence of this interactional configuration in the games is presented in Section 3 of this article.

In strictly competitive games (institutional duels), relational empathy does not involve decoding the other or others to be effective (as in animal ethology). Thus, in dueling sports, game rules regulate the flow of empathy with the aim of utility or gain. It is preferable neither to have positive feelings for the opponent nor to be overwhelmed by emotions. Ruse, deceit, bodily manipulation (feint, lure), and verbal manipulation are therefore crucial in these encounters. We regularly hear athletes say that, if friendship persists, it is left in the locker room. Empathy and understanding of the other are self-serving and non-communicative.

In traditional games, relational networks are sometimes ambivalent, depending on the choice of players. The player can choose to team up or oppose. This is the sphere of "paradoxical games"—a special concept that belongs to a category of games that increases the originality and complexity of the social bond. These are so-called paradoxical games that immerse players in an ambivalent network such that each player is at the same time adversary and partner of any other participant (Parlebas, 2010).

3.1. Empathy at the heart of sporting games

Empathy may be assessed and improved through physical games. Indeed, the modern monistic conception of the person encompasses all human relationships. What could be simpler than using ludomotor games to achieve that goal? "To be able to engage into emotional empathy, you need presence, you need body in a space–time that supports direct face-to-face," as Zanna and Jarry (2019) stated. Furthermore, according to Goffman, "a well-aware person who wishes to avoid emotional overflowing needs to engage in cognitive reflexivity (Warnier, 1999).

Empathy is a concept that has come to the fore in the scientific literature in recent years. However, we should not forget that it is protean, subject to controversy, praised or, on the contrary, subject to suspicion. The effect of fashion has contributed to a magnifying glass effect on the concept of empathy by enlarging the positive or negative traits and the advantages and the disadvantages. However, the specialness of empathy is to be multidimensional.

The concept of empathy has its roots in Robert Vischer's works from the nineteenth century, which emphasized a feeling that arises within the context of esthetic experience (Einfühlung). According to Pacherie (2004), it is the ability to comprehend what another person is thinking and feeling while keeping in mind that the other person is not the same as the individual. In fact, it makes sense to employ the "as if" idea from the Rogerian method to better describe that sentiment/circumstance. In addition, research supports a variety of forms of empathy that are linked to both main components: emotional and cognitive affection (Decety and Jackson, 2004; Batson, 2009).

3.2. Empathy as a multidimensional concept

The primary characteristics of empathy may be agreed upon from the expression: "Empathy has two faces, like the god Janus of antiquity" (Tisseron, 2011). On the one hand, it allows us to have a mental representation of the mental and affective functioning of our interlocutor; on the other hand, it brings us into resonance with sensory and emotional states." Empathy thus has two aspects—cognitive and affective emotion. In other words, it has two interacting elements (Decety, 2010): (1) a more automatic and hardly intentional motor resonance and (2) a more controlled and intentional subjective perspective of others. Zanna and Jarry (2019) summarized these two dimensions when a situation finds at least two people in interaction: cognitive empathy allows us to understand the other and to represent him or her to oneself, while emotional empathy is a face-to-face relationship where we resonate with the other (through the body and language) while maintaining the "right" distance so that he or she need not be emotionally confused. This subtly differentiates empathy from sympathy and compassion (feeling the pain of others for the sake of the other). In short, for Zanna (2015a), as for other specialists, empathy offers the discovery of "another possible self."

Cognitive empathy cut off from its emotional dimension (e.g., having no need to experience one's emotions) can be a dangerous weapon that is used to manipulate others for one's own ego (maximizing one's gains, pleasure, or enchantment at the expense of the other). The risk is also to be overwhelmed by one's emotions, which can lead to passivity, refusal, or denial (of the other), depending on the situation experienced. Finally, bias can occur through empathy and interfere with moral behavior, especially by favoring one person or group (Decety and Cowell, 2014).

Thus, in the literature, it has been argued that while empathy can generate risks, the absence or lack of empathy is conducive to deviant, inappropriate, or violent behavior. It can even lead an individual to mistreat, harass, or attack others (Dugas, 2020). However, it can also be beneficial in certain circumstances: "Imagine a surgeon operating on a loved one! Better to cut yourself off from such emotional empathy in such a situation, although only for a while."

Finally, we should keep in mind that empathy is mature "if there is an intentional solicitation of her two components, by adopting the affective perspective of others, for instance" (Decety, 2020). Advances in knowledge, especially knowledge linked to social neuroscience, reveal that empathy is a disposition specific to humans from an early age. Certain brain regions are responsible for morality and our moral sense. Among other human qualities, this empathic predisposition plays an important role in the subsequent emergence of prosocial behaviors linked to concern for others (Decety, 2020), offering benefits for social life generally.

As a result, by questioning the expression of empathy in sporting games, we focused on those with several players, each of whom represents a place of intersubjectivity in which the players test themselves through physical contests.

According to many studies, some of which have been presented in this study, bodily games, particularly traditional sporting activities,

tend to encourage and strengthen participants' empathic behavior. If empathetic dispositions are present at an early age (Decety and Holvoet, 2021), exercise through body games would reveal and preserve their full potential. Thus, empathy may be considered a pedagogical construct that can be better handled if the internal and external logics of some classic sports activities are thoroughly investigated. To date, few authors have researched in the field of gaming, in their functioning and in their unique traits (Parlebas, 1995). Are sports, however, the only games that may reveal and encourage empathetic conduct, according to the scientific literature? How can TSG foster educational and social innovation, as well as empathy?

4. Empathy improvement through motor interaction games

Many games with high bodily embarrassment, namely, roleplaying or theater games, are inspired by TSGs or resemble them in terms of the relationships between participants. While words can accomplish things (Dugas et al., 2022; Dugas, 2023), "more inclusive bodily engagement is the glue that holds empathetic flow up for an education in empathy to "educate emotions" (Zanna and Jarry, 2019). Thus, games designed for this purpose, particularly TSG, may effectively offer a multitude of educational, social, and societal values, especially when designed by work in the field of motor praxeology (Parlebas, 1981, 1999, 2020). Accordingly, they allow for the discovery of: (1) the development of "creative skills" within communal sporting practices (Obœuf et al., 2020); (2) the reciprocal impact of traditional games and collective sports from the perspective of learning transfer (Parlebas, 2005a; Dugas, 2011b); (3) aggressive or cooperative behavior through the Sitting Ball Game (Obœuf et al., 2008; Dugas, 2011a); and (4) emotions and wellbeing (Lavega-Burgués et al., 2023). Recently, our reflexive path led us to believe that TSG, studied in its intrinsic reality and for itself in an inseparable relationship with the practitioners working within it, opens the door frequently to unnoticed or unknown potentialities, which we have discussed through the examples of games in the following sections.

4.1. The bear, the guardian, and the hunters

The bear, the guardian, and the hunters are examples of three chained roles (Parlebas, 2000; Loyer et al., 2015; Martínez-Santos et al., 2020). According to the game's internal logic, the guardian's purpose is to safeguard the bear (who is immobilized with a rope connecting him to his protector) from assaults (hunters). These hunters try to touch the bear as the guard tries to touch the hunters (Figure 2). The players switch roles with each touch: "It is a ternary relationship that mobilizes three individuals with various respective duties and is completed from the guardian to the bear through a hunter" (Parlebas, 2000). Throughout the game, any participant might adopt the three roles. It indicates that a partner may become an opponent (the defender can become a hunter), which means that each player can put himself in the role of the other and experience what he/she experienced. Changes in roles are central to this game. Thus, the interaction network is always changing, and there are no systematic permutations because role changes are related to the players' immediate successes and failures, their impulsive decisions, and their interpersonal preferences. This style of game is devoid of accountability (no score) and a stopping rule.

Such role changes in sport are certainly implausible since the interactional network is fundamentally stable (a player never changes teams during the game).

For decades, the permuting role changes permitted in TSG have been the structural foundation of non-institutional games focused on empathy, in which bodily engagement is essential, as described in the following.

Observation of players in the games of the Bear, the Guardian, and the Hunters showed that, in this TSG coexperienced body/body resonance game, participants shared emotions (affective arousal and emotional stimulation). Additionally, it demonstrates an empathetic concern (Decety and Cowell, 2014) between the guardian and the bear (motivation to care about the other) by assisting in observing the other in the game and taking behavioral indicators. The following sections may serve as an education in acting through a kind of "interactive building through experience" in this game (Debarbieux, 2008). Overall, the purpose is to reduce violence to improve interpersonal wellbeing and empathy (Favre, 2007).

4.2. The four musketeers game

An interactional sports activity known as "the game of the musketeers" was developed by a researcher (Omar Zanna) and a trainer (Bertrand Jarry) and was initially attempted on prisoners to recover the perceived "lost" empathy (Zanna, 2010). The musketeer's game has also been employed, particularly, with young primary school pupils (7–9 years old). The suggested scenario's internal logic dictates that the players compete in four-player teams. The first player has his arms spread parallel to the ground, the second to the sky, the third stands on one leg, and the fourth called the joker keeps running around the room on a predetermined path (Figure 3).

If one of the first three players becomes exhausted, the first three players have the right to request that the joker be replaced. As a result, the group that holds its position the longest wins the round. Also, the roles in this game are changing (fluctuating). Thus, players are encouraged to express themselves verbally and physically after each round. The authors state that using these activities in classrooms will promote a positive educational atmosphere. Accordingly, Zanna (2015b) has stated that the idea of a link between facial expression, physical expression, and emotion implies, on the one hand, that emotion translates bodily manifestations, namely, facial (Izard, 1977), and, on the other hand, that these same expressions are indices of the emotion (Tcherkassof, 2008) that one wishes to share with others (Maury, 1993).

The game experience was followed by collective reflexivity, in which students verbalized their feelings and/or acquired knowledge (concerning the empathic concern). The repetition of the game and

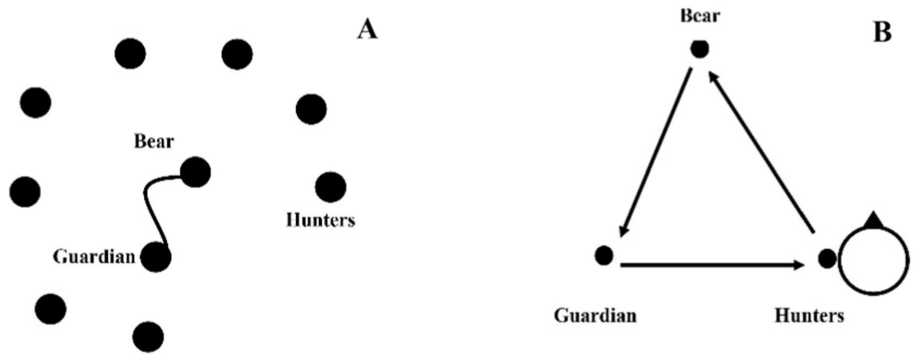

FIGURE 2
(A) Graphic representation of the game "The Bear and its Guardian." **(B)** Mapping of the network of permutable and interconnected roles in the game using graph theory (Loyer et al., 2015).

the verbalization after and between the sessions are seen as reinforcers of the previous experience (increasing motivation to empathize with the other) that allows, over time, to stimulate and comfort empathic perspective sharing.

Indeed, three levers have been extracted from the implementation of the Four Musketeers' game in schools and colleges and inspired by Decety and Cowell's (2014) empathy processes:

- The first lever is concerned with emotional awakening and stimulation.
- The second lever is the empathetic concern (motivation to care about one's partner): To monitor the opponent player in the game and to receive behavioral signals from other musketeers as a team.
- The third lever is perspective-taking through cognitive empathy and social reasoning. It is a question of learning basic life rules as a person and as a citizen in society.

All interactional dynamics in physical engagement betray a fantasy existence by taking on roles, changing roles, and confronting counter-roles.

4.3. The school catch–wrestling experiment

Catch–wrestling is a "complicated opposition," which means that the reproduction of gestures by behaving and acting "as if." This involves a form of "economic" rivalry in which opponents collaborate depending on the circumstances and opportunities. The player's behavior is fluctuant, thus, "Sometimes [the player] exceeds the ring's formal limit and continues to attack an opponent who is legally protected by the ring ropes. Other times, he re-establishes this boundary and demands protection for what he did not respect in the previous minute" (Barthes, 1957). Hence, catch–wrestling requires combat strategies in a complicated relationship between two or more players. It's a "fighting spectacle" in which one person appears to exert physical dominance over another while the other refuses to express his or her emotions publicly. The catch exercise was

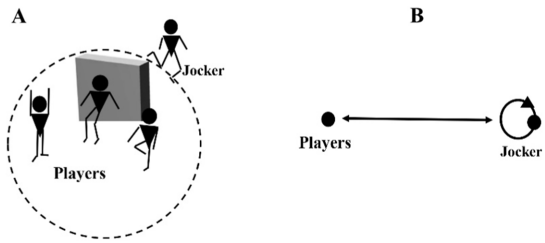

FIGURE 3
(A) Illustration of schematic and **(B)** mapping of the network graph of permutable roles in "The Four Musketeers Game."

given to students with the instructions to break the rules in order to teach them and prepare them for role-playing scenarios.

We presented catch-wrestling in a novel way as a substitute for school wrestling to make it instructive and to build empathy via "teamwork" through physical engagement. Two studies were carried out, the first at a professional high school (Loyer and Dugas, 2014) and the second at a primary school in a priority education zone (Dugas and Loyer, 2018). In both cases, the teacher assisted students in reflecting on potentially "deviant" behaviors to better understand and, maybe, control them. The scenarios presented include an aggressor, a victim, and an observer. Consequently, it was meant to offer a range of collaborative games structured around a subject and to integrate simple motor addressing strategies in groups of four over the course of an eight-session learning cycle (mixed group).

School catch–wrestling was interpreted by us as a traditional (non-institutional) sporting game in which the players establish and manage the rules based on their preferences and feelings. This novel-designed TSG, on the other hand, falls within the category of didactic sporting events, which encompass "all motor situations codified by instructors under educational principles and for instructional aims" (Dugas, 2004). The fundamental purpose of the proposed cach-wrestling game's internal logic is to keep game morality by proposing a situation in which a "perfect bastard" fights against a "hero," as recommended by

previous research (Barthes, 1957; Loyer and Dugas, 2014). Besides this, the permutable interactional network structure is intended to increase collaboration rather than to combat where gestures "simulate violence."

According to the findings, second-year students were more competent in expressing themselves verbally and in writing during class. They immediately imagined a fact-based scenario at a disco. The topics of discussion included civic engagement and education, respect for others, gender equality, teamwork, injustice, and friendship, among other things.

Similarly, the instructor suggested some places, things, and scenarios related to intimidation to the youngest primary students (9–11 years old). These young people created an amusing roleplaying game out of short films (animated designs) to combat partner intimidation (Dugas and Loyer, 2018). Thus, the originality of the catch–wrestling game is to simulate violence in a rigorously cooperative game where everything is openly discussed.

The emotional and cognitive components of empathy have been identified and integrated (empathy has matured). Students who witnessed aggressive conduct were given contradictory responses: support the aggressor, be indifferent, and help the victim (in various ways).

To summarize, a few criteria must be respected in school. Catch–wrestling as a path for empathy teaching through corporeal involvement to avoid any emotional misunderstanding that is conducive to hate or opposition to the objectives pursued:

- First, empathic flow through interactions is an ingredient of individual and collective wellbeing when deployed in a controlled, collaborative, supported, and monitored context over time (Curchod-Ruedî et al., 2011).
- Second, in terms of learning input, four phases must be followed, based on specific principles (Zanna and Jarry, 2019): practice together by engaging physically; observe others; switch roles; and talk about feelings by expressing them.

The original school catch–wrestling game, among non-zero-sum games, demonstrates the benefits of moving away from strictly competitive games in terms of empathetic concerns. As a result, the internal logic of the game might potentially fit into an empathy education curriculum.

5. Empathy improvement through complex, paradoxical, and digital games

5.1. Empathy in the four-corner game

Social interactions in sporting events are both verbal and non-verbal (Parlebas, 1999). As a result, "one participant's motor activity influences one or more other participants' behavior visibly" (Parlebas, 1999). This effect may be seen as a function that facilitates the performance of the motor task, where collaboration is encoded as "communication," while opposition and resistance are processed as "counter-communication." Considering this, some ludomotor game events, known as paradoxical situations, allow for complex, ambiguous, and ambivalent partnerships (Parlebas, 1999, 2005a,b). As the participants' contradictory behavior leads to a dialectical background with a rich social, psychological, and educational context, these activities continue to defy classification. The stages of alliance reversal that are the cause of uncertainty may also be identified, and they are viewed as a free strategic choice between cooperation and competition, or even possible apathy toward other participants (Parlebas, 1999). Individual strategy, motor control, and affectivity are all emphasized. Increases in autonomy and decision making are gains in learning in this situation. The investigation of the paradoxical four-corner game, which we present here as an example, was extremely fascinating in this regard.

The four-corner game is well renowned for being played in a 5-m^2 area (Figure 4). The game usually accommodates five players, one in the middle (central role) and the others in each of the four corners (corner role). The players in the corners attempt to exchange corners at their leisure to avoid being overtaken by the player in the center. The player who is left without a corner occupies the center. Since each player can choose whether to collaborate or to oppose the participants in the other corners, the rules allow for the development of ambiguous or of paradoxical interactions. When two players agree to switch corners in this game, they collaborate by coordinating their efforts.

The internal logic of the game state that, when players dispute on the same corner of choice, corner players are both friends and enemies. Nonetheless, a preliminary analysis may reveal the core connections between rivals (R = rivalry) and partners (S = solidarity).

The four-coin game allows players to become partners or opponents. When one player decides to exchange his corner with another one, the other player decides quickly to move backwards and reclaim his position. If the supposed partner loses his corner during this maneuver, the player

FIGURE 4
Illustration of the spatial organization of the players in the four-corner game (Ben Ali, 2018).

who was previously a potential partner becomes a declared rival. The position of one of the players, who was formerly a partner, abruptly transforms from a potential partner to a declared rival when that player becomes restricted. Parlebas (2005b) claimed that analyzing the four-corner game graph (equation 1) results in the formation of a non-exclusive bigraph.

$$R \cap S \neq \emptyset \quad (1)$$

Any non-verbal cues that corner players share during natural conversation are referred to as non-verbal communication. In the present game involving a complex motor interaction, messages are discreetly sent, and non-verbal cues have highly specific importance (Vinciarelli et al., 2009). This is what upset interest in comparing how playing a paradoxical game affected the empathetic process in young people starting school (primary school) at the age of 6–7 years with young people starting university at the age of 19–20 years (Ben Ali et al., 2020b). The extent of "spatialization" generated by all interactions and the empathy process is at the core of the topic under review. A sociometric analysis of interindividual interactions during the paradoxical four-corner game was produced as a consequence of this research. Two semi-structured interviews were added to the observation, which had already benefited from a quantitative and qualitative analysis of the in-game behaviors and behaviors that could be observed *in situ*, to shed further light on the players' attitudes and intents. The interviews were carried out once at the end of the game (without watching the scenes) and once more after 15 days with scenes from the players' game in front of them.

There was a significant difference related to the behavior of players, and it was correlated to their age. In fact, at the youngest ages, the sociometric matrix was significantly correlated with central-player searching behaviors around oneself. Despite common belief, the interviews revealed that older players exhibit less transparency in their actions. Their goals are concealed by their acts. Even better, they do it with awareness. However, they are better able to explain and decrypt the anti-communication goals throughout the viewing process.

In brief, during the traditional four-corner game, young people aged 6–7 years showed more expression of the inter-subject empathy process. Their intentions to give way to the player in the middle were identified as an act of empathy to aid him in playing with them, even though this remained a contradictory behavior in and of itself.

5.2. Empathy in sitting ball game

The Sitting Ball Game (SBG) replicates the ambivalence and instability of social life by enabling players to choose their partners and opponents and to change them throughout the game. As a result, this playful organization differs significantly from sporting structures in which ambiguity and instability have no function. According to Obœuf et al. (2008), it is structural uniqueness that will allow individuals to participate in the SBG, regardless of whether their bodies maintain or not the socioaffective connections created in other contexts.

In the SBG (Guillemard et al., 1984), the players are distributed over the playing field and attempt to elude a highly convoluted ball. The movement of the ball is one of the constraints. Thus, players are not assigned to a team, and when they have the ball, they may choose if they want to draw over an opponent or pass for a partner. However, if the player wants to pass the ball to another, he/she has to bounce it on the ground, while a shot on the opponent should be in the air. If the ball touches one of the players, he/she becomes a prisoner and must sit on the ground. He/She must then wait to be released by a participant's pass (partner) or by changing bounces (from an opponent).

The rules of the SBG allow for ambiguity and paradox during the game (Figure 5). As a result, the player chooses his or her partners and opponents at any time throughout the game. Thus, he/she has the opportunity to cooperate or oppose at any time. Indeed, one is constantly on the lookout for other players, which is one of the

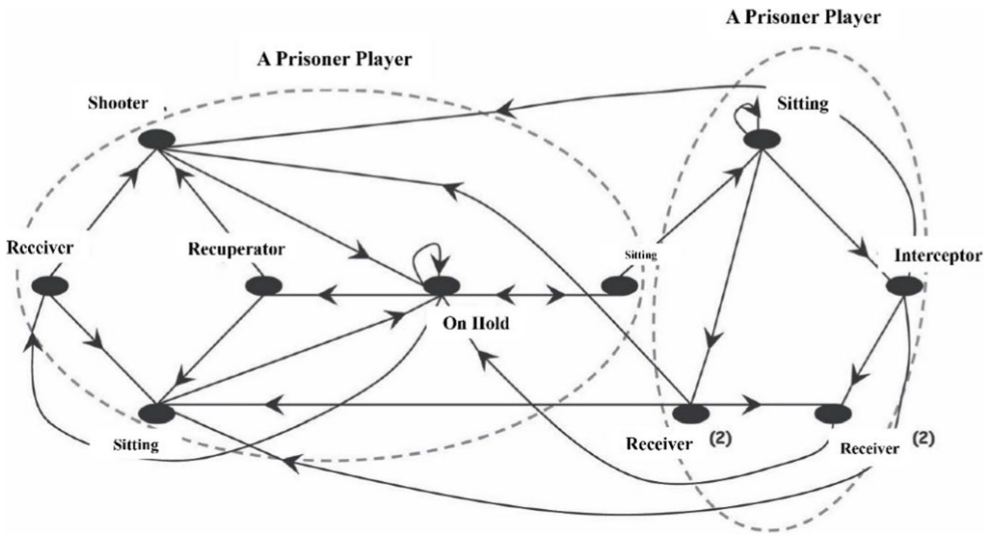

FIGURE 5
Interaction Graph representation of the Sitting Ball Game (Obœuf et al., 2010).

characteristics and levers of empathic availability and emotional education (Zanna and Jarry, 2019). The four steps include physical play, observation, role changes, and verbalization after the fact. These are the constituents that will promote empathy.

The ambivalent interactions (Obœuf et al., 2008; Lavega et al., 2018) lead player interactions into ambiguous or paradoxical situations where each player is potentially both an ally and an opponent of the other players at the same time (Parlebas, 2016). Against this backdrop of contradictory relationships, it is hard to predict the players' behavior because each one will act following his or her subjective socioaffective preferences at different times during the game (Obœuf et al., 2008). Some researchers argue that we can use surveys to determine the structure of socioaffective relationships as well as the connection of interlink communications by observing them throughout the game (Parlebas, 1999, 2005b; Obœuf et al., 2008). With the use of graph theory, the two networks were then compared (Bornholdt and Schuster, 2001). If the comparison revealed a strong link between these two networks, it implied that the actors made passes to the players they liked the most and the passes were not made to the players they liked the least.

Moreover, "deviants" who take the risk of shooting an in-group member or passing the ball to a member of another group are immediately punished. Then, members of the in-group no longer transfer the ball to them or, worse, they "kill" them to give them time to reflect on their transgression of group norms. Obœuf et al. (2010) noted that "it is the group's social control over its members that makes these acts (shooting for the in-group or heading for the out-group) look abnormal. As a result, collective authority cannot be challenged." Indeed, whatever the game, we generally put ourselves "in the place of the other" to understand their viewpoint on the forthcoming action and anticipate their reaction. Obœuf et al. (2010) stipulated that "This empathy is highly dependent on inferential mechanisms (Bromberg, 2004), i.e., the context (Bateson, 1951), or internal logic (Parlebas, 1981, 1991, 1999)." In the case of the "sitting ball," where empathetic acuity plays a major role, it allows escaping. Some games do have an unanticipated socioaffective coloration (Obœuf et al., 2008). In terms of socialization, the distinction between the SBG and institutional sports is significant. The forms of communication and meta-communication generated by the game's internal logic provide insights into the subtle pathways via which socializing occurs.

In other words, some individuals are more skilled than others at predicting the intentions of others; in a nutshell, they have greater empathy. As stated by Obœuf et al. (2010), "there is a superposition of protagonists in 'SBG' who best perceive the choices of others at the socioaffective level (sociometric questionnaire) and those who show themselves to be the most effective at the instrumental level, having the most developed dodging abilities."

5.3. Empathy in video, "Phygital," or digital games

We are concerned about the future of traditional sporting games, but we cannot dismiss the technological advancements that are infiltrating the daily lives of humans, particularly children. As a result, in the face of a dazzling expansion of digital and "phygital" games, bodily involvement and physical interaction are frequently challenged. While physical games promote social and emotional interaction by requiring the physical presence and engagement in a "face-to-face" situation (Parlebas and Schmitt, 1975; Tisseron, 2011; Zanna, 2015b; Dugas and Loyer, 2018; Zanna and Jarry, 2019), they also assist with the joy of acting, commitment, and, for some, the development of empathic skills, particularly on the affective-emotional side. However, what about more distant games such as digital/video games and virtual reality (VR) games?

Meta-analyses demonstrate that, depending on the degree of technology immersion, the development of empathy is varied, but always superior to basic frequently communicated information (Herrera et al., 2018). Indeed, the conventional definition of empathy is to put oneself in the position of another. If this perspective enhances participants' empathy, the effect is smaller as compared to technology, especially if the virtual/digital world is immersive. Finally, several meta-analyses devoted to empathy (Tassinari et al., 2021) have shown that, across all kinds of media used, and under particular situations, VR with the embodiment of a virtual character produces better effects (Ventura et al., 2020). This idea has been supported by examples of intergroup interactions. Paradoxically, computer-mediated communication can have an impact on the participants' empathetic capacity (Nicovich et al., 2005).

To summarize, regardless of the media used (textual, virtual, digital, or others) to improve empathy that helps us live more harmoniously together, the closer we come to physical reality, the more substantial its impact appears to be. The more we engage the participants' senses (visual, auditory, and proprioceptive systems) and copresence, the more realistic and sustained the impact seems. The current state of the art permits us to hypothesize that, in the context of "phygital" games (escape/serious games). The more significantly individual's body is sollicited, the higher the degree of his motor involvement. Furthermore, the more immersive the media, the closer we are to a realistic scenario, and the greater the influence on empathy, assuming that the empathetic mechanism is effectively mastered. For example, researchers simulate blindness by covering the participants' eyes. Despite evoking demonstrable "empathic care," the situation has resulted in misinformation and reinforced stereotypes (Silverman, 2015). It is not a question of bringing into play persons who experience otherness to generate, stimulate, or induce empathy. Empathic care necessitates a pedagogical effort, which can be enhanced by the use of conventional or comparable sporting games.

6. Conclusion

In this study, we attempted to emphasize the educational significance of traditional sporting games. The major goal of the study was to demonstrate how these games provide a diverse spectrum of human interactions that enhance availability and empathic attitudes.

Traditional sporting games have numerous varieties that allow players to be both actors and authors of their interactions. Indeed, the ludomotor face-to-face interactions create care for others, and when one pays attention to the other (empathic awareness), the intention to help the other (empathic motivation) is stronger. This is the cornerstone of relational empathy education.

As a result, we attempted to broaden the domains of the praxeological and structural analysis of TSGs by employing the prism of original empathy in Section 3 of this article. Furthermore, examining the interaction systems through the prism of the internal logic of the games helps us better comprehend the "I," "you," and "we" that combine to form emotional connections. According to Parlebas (1981), there was "I" in the "game," but there was also a "game" in the "I."

Moreover, many research studies, some of which have been discussed in this article, reported that body games, particularly traditional sports activities, typically boost and reinforce players' empathic behavior. Thus, if empathic dispositions are present at a young age (Decety and Holvoet, 2021), exercise through body games would uncover and preserve their full potential. Such is the case with paradoxical games, which offer further decision-making flexibility than institutionalized games. This analogy is explained by Pierre Parlebas, who argues that, in sports, "what counts is what counts." From this point of view, there is less prospect of socioaffective interactions interfering significantly with the sports gaming process. They undoubtedly play a role, but it is measured. The internal logic is a manifold of efficiency, and friendship gives way to operationality (Obœuf et al., 2010).

As a result, it is easier to conceive a mutual help connection in TSGs (Reynaud and Richebé, 2009). These motor situations imply that players dare to interact together by participating with themselves since when you join a game, you are doing it for the pleasure of moving, interacting, and doing things together. Therefore, we believe that these games provide educators with several opportunities to contribute to education in empathy and its associated dimensions through their internal logic coupled with didactic processing. The concept of the school catch-wrestling game, presented in Section 3 of this article, would be an outstanding demonstration of a scenario capable of bringing into action collective dedication amid difficult circumstances. In this sense, Parlebas (1975) specifies that "despite what tenacious tradition maintains, gambling is an activity that is neither free, nor disinterested, nor sterile." Nonetheless, this playful face-to-face interaction remains a second-degree "genuine fiction" in which the player immerses himself in the same seriousness as in reality (Brougère, 2005). Additionally, first-person observation of the game deviates from its original meaning, generating a confessional circle around phrases such as labor, learning, or education. In short, games give amusement while also having the ability to be instructional, favorable to learning, and even teach empathy.

In terms of perspectives, traditional sporting games can bring a variety of educational, social, and societal benefits, especially concerning work relating to motor praxeology (Parlebas, 1981, 1999, 2020). Indeed, they allow researchers to learn about (1) the development of "creative skills" within team sports practices (Obœuf et al., 2020); (2) the reciprocal impact of traditional games and team sports on learning transfer (Parlebas, 2005a; Dugas, 2011b); (3) aggressive or cooperative behavior through the SBG (Obœuf et al., 2008; Dugas, 2011a); and (4) emotions and wellbeing (Lavega-Burgués et al., 2023). Finally, our reflective analysis led us to believe that a TSG, studied in its inherent reality and for itself in an inseparable relationship with the practitioners who work within it, opens the door to potentialities often unnoticed or passed over in silence.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

ÉD and BB actively and equally participated in the design of the study and in shaping the final version of the manuscript. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Roles, relationships, and motor aggressions: Keys to unveiling the emotions of a traditional sporting game

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International organizations such as the UN and UNESCO set priority goals for education in the 21st century. This article shows the educational contribution of the Traditional Sporting Game (TSG) of Bear Guardian and Hunters that involves the three-chained roles. The three roles test players who share a unique social interaction ritual. This study was part of a training experience for university students in physical activity and sports sciences in the theory and practice of motor games subject at INEFC, University of Lleida (Spain). This research investigated the emotional intensity in these three roles, the emotional meaning units, and their correspondence with the emotional triad. This study is a mixed-methods research. After playing the game involved, 131 university students (46 women and 85 men) aged 18–35years (M =20.19, SD =2.42) answered the validated GES-II scale indicating the intensity and causes of five basic emotions. The data were analyzed using different strategies (qualitative data: content analysis; quantitative data: descriptive statistical analysis, inferential and association rules). The methodology employed has revealed part of this game's secret (intimate and subjective) code: the affectivity invisible to external observation. Among the findings, we highlight: (a) each role originates different intensities and units of emotional meaning; (b) the three roles feedback, need and complement each other in this socio-affective network of interdependent relationships; (c) the Bear is the central role of the game. The emotional meanings concerning the motor aggression of the Bear operate as a magnet that attracts four itineraries of association rules of meanings and emotional triads. In the hands of intelligent, prepared and sustainable teachers, this game can help students learn to live together and educate them to control and respectfully channel motor aggression. In this way, students will be active actors in the process of civilization in favor of sustainable development.

KEYWORDS

coexistence, motor praxeology, quality education, sustainability development, affectivity, traditional game, physical education

Introduction

Social interaction as ritual

Since human beings are born, we learn to live with other people in different interactive contexts. Living in society implies daily participation in rituals of interaction that take place on a small scale, here and now, face to face, where the relationship builds people as social subjects (Goffman, 1983; Collins, 2009).

According to Goffman (1983), social relations establish a ritual order. Thus, in any social interaction, actors perform some Role. This performance or enacted Role is addressed to the other interaction participants and potential observers. Social interactions represent the roles that each actor has internalized in such a way that they form part of their own identity.

Roles play a fundamental role in the interaction between people, indicating the type of conduct their actors are expected to carry out in a given situation.

When interacting with others, the person shows a specific type of information about him/herself, depending on the situation and the intention, which will provoke different responses depending on how others interpret him/her. As in a theater, there are pre-established behavioral limits in every interaction, a script to be interpreted in front of others.

This ritual order makes sense in the social and cultural context in which it takes place. Thus, in the rituals of interaction, people intervene following the social norms of their community or society. Furthermore, in any social interaction, a ritual is created that organizes and orders the relationships between people and how they express and manage their emotions. The flow of emotional energy that actors share (when emotions enter into reciprocal consonance) is a central ingredient and outcome of the interaction ritual (Collins, 1984, 2009).

From this shared emotional energy emerge symbols of social relatedness that evoke a sense of belonging to a group. People interact in an affective encounter with themselves, others, and their environment in everyday life. Thus, emotional literacy takes place, which favors the civilizing process of self-control of emotions in a modern and complex society such as ours (Elias, 1987).

In this context of emotional literacy and self-control, interpersonal relationships are governed by two interaction rituals: power and status, which have a specific emotional energy. According to Kemper (1981), in power interactions, there is an expectation to dominate others, whereas, in status relationships, one seeks an exchange of relationships to satisfy his or her own needs, as well as other participants' needs and wishes.

Some power interactions can give rise to interpersonal conflicts and even to aggression or physical violence involving the use of force (Elias and Dunning, 1994).

Interaction rituals facilitate their actors' social and emotional literacy, channeling violent and aggressive behaviors into cordial and respectful relationships. According to Goffman (2004), the order of social interaction is sustained by a moral order that is constituted around care, protection and respect for the members who participate and are recognized in this social system. Behavior must be honorable, dignified and respectful in a social encounter. Failure to meet these expectations implies a deviation from this moral order (Goffman, 2004).

Challenges in the 21st century to educate sustainable rituals of interaction

A straightforward way to identify the priorities for education in the 21st century is to look at the guidelines set by such representative international organizations as the UN and UNESCO. Irina Bokova, Director-General of UNESCO, indicated a few years ago that "now, more than ever, education has a responsibility to be attuned to the challenges and aspirations of the 21st century and to foster the right kinds of values and skills that will lead to sustainable and inclusive growth and peaceful coexistence" (UNESCO, 2016, p. 6).

Thus, the challenges of all modern education tend to align with the Sustainable Development Goals (SDGs) adopted by United Nations (UN) (2015), an ambitious and universal agenda to transform the world. Physical education should also orient its priorities toward Education for Sustainable Development (ESD), seen as a critical instrument for its achievement:

- *SDG 3: Good Health and Well-being* related to ensuring healthy lives and promoting well-being for all ages. In this goal, the learner can encourage others to decide and act to promote health and well-being for all.
- *SDG 4. Quality Education to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all*. The learner understands that education can help create a more sustainable, equitable and peaceful world.

Through these two objectives, students should learn to participate in rituals of interaction that trigger socio-emotional experiences of health, well-being, sustainability, equity, and peace.

Thus, sustainable development education has to develop competencies that empower students to reflect on their actions, considering their current and future social and cultural impacts from a local and global perspective. Sustainability students should engage constructively and responsibly with today's world. According to UNESCO (2016), the learning of SDGs includes cognitive, socioemotional and behavioral elements. Hence, they are an interplay of knowledge, capacities and skills, motives, and affective dispositions.

Physical education in the 21st century, learning to live with new rituals: Sustainable motor interactions

A careful reading of the foundations established by the Education for Sustainable Development Goals (United Nations (UN), 2015) has made it possible to identify learning objectives, competencies, procedures and other priority guidelines to which modern physical education should respond (Niubò-Solé et al., 2022).

The architecture of this physical education for sustainable development should be built on three pillars:

- Quality education. PE has to be understood as an integral part of quality education.
- Educate sustainable social relationships: health and socio-emotional well-being oriented toward an equitable and peaceful world.
- Action and reflection in action. Competencies are acquired during action based on experience and reflection. They activate cognitive, socio-emotional, and behavioral domains.

To respond to these challenges with solvency, a scientific discipline is needed to generate evidence and apply scientific knowledge. It is necessary to promote physical education based on scientific evidence. The theory of motor action or motor praxeology offers a new vision, a paradigm shift, by conceiving physical education as a pedagogy of motor behavior (Parlebas, 2001). From this perspective, the student is the center of attention who, by participating in a game, sport or physical

exercise, activates his or her whole personality in a unitary and systemic way.

To educate motor conduct, the trainer has a wide range of educational resources (games, sports, exercise) that will test the students in different motor interaction rituals.

According to motor praxeology, each motor practice has a singular internal logic which requires the student to have a specific way of relating to the other participants, to space, to objects and to time (Parlebas, 2001).

Each game triggers a frame of meaning (Goffman, 2007) in which players engage in contextualized motor conduct (Parlebas, 2001). This context of meaning corresponds to the implementation of rules understood as a set of rights and prohibitions that players have decided to accept. This is how each game or sport originates a singular motor interaction ritual that will elicit motor conduct of a different nature.

The concept of motor conduct refers to "the meaningful organization of the actions and reactions of a person who acts, the relevance of whose expression is motor in nature" (Parlebas, 2001, p. 85). Motor conduct goes beyond the mechanistic and decontextualized view of the movement to refer to the unitary intervention of the person. This concept is particularly noteworthy; it relates to the person as a unique, singular being which expresses all its dimensions when engaged in organic, cognitive, emotional and relational levels (Parlebas, 2001).

The traditional sporting game (TSG) deserves special attention among the possible pedagogical resources. The rules are linked to the local culture, and, unlike sports, they are not governed by an institution or federation (they are not institutionalized).

The social and interactive nature of the TSG rules activates a unique web of symbolic relations between the players (Geertz, 2003). The originality of this symbolic ritual is that it corresponds to lived culture, played and expressed through motor actions (Parlebas, 2001). We are dealing with a lived intangible cultural heritage, that is to say, in the case of the traditional game, with a played intangible cultural leisure heritage.

The rules of the TSG are authentic showcases, repositories of the values and the type of motor interaction representative of the community that hosts them. They are a strong vector of socialization, behaving like miniature societies (Parlebas, 2000) that give life to a wide variety of rituals of motor interaction.

> The TSG are frames of the meaning of immediate physical presence, where people express a vision of the situation, of others and themselves. "The positive social value a person effectively claims for himself by the line others assume he has taken during a particular contact" (Goffman, 1970, p. 5).

The originality of the TSG lies precisely in the diversity of their motor interactions. Sometimes a player plays alone (skittles), while in other games, he or she cooperates with more than 500 people (human towers). Some games that pit two people against each other (wrestling games) or two teams (such as Dodgeball), just like Olympic sports.

The TSGs maintain original rituals of motor interaction that are not present in the interactive structure of sports. There are games in which people can change teams during the game (e.g., a chain game in which, in the beginning, two people chase each other, and at the end of the game, they all go together against the last player). In some paradoxical games, players are potential partners and opponents of each other (e.g., the four corners in which corner players can ally or betray each other as they wish; Lavega-Burgués et al., 2022).

Learning to live together with others involves sharing relationships and emotions in a wide variety of motor interaction rituals, which the TSG also offers. In this ludomotor plot, the biological nature of emotions is harmonized with the social nature of play (Kemper, 1981). The affective subjectivity of each actor (motor conduct) is intertwined with the objective social situation offered by the rules of any game (internal logic). Moreover, in the case of the TSGs, as they are rules of local tradition, the emotions carry the meaning of the social norms of their community. They are "feeling rules" (Hochschild, 1979) that define what it is appropriate to feel in each of these rituals of social relations (for example, to be happy when our team wins, even though we have not played well).

In this ritual of motor interactions, emotional responses depend on each person's interpretation of the motor situation in which he or she is involved (internal logic). Emotions also respond to the meaning that originates from the exchange of interpersonal signs (motor behaviors) with the other participants (Lavega et al., 2014).

> "A group microculture emerges in this interpersonal exchange of signs, which generates and transmits a system of norms, values and common ways of doing things to establish a cognitive, relational and affective network of shared socio-motor meanings" (Parlebas, 2016, p. 178).

TSGs correspond to frames of meaning (Goffman, 2007), i.e., contexts loaded with social meanings that give sense to the actions and symbols transmitted by their actors. According to the culture, there are different ways of interpreting the social world, the symbols and the rituals that each actor must follow in this social interaction. In this way, each TSG originates a web of ritualized socio-affective motor interactions.

The TSG players participate in living and real procedural learning in this ritualized weft. Each person is free to orient their motor interactions toward a relationship or ritual of power or status interaction. Moreover, in some cases, the rules authorize the exchange of intense motor interactions, as in the traditional game of Bear-Guardian and Hunters.

These games become potent educational resources whose potential can educate interpersonal relationships in a playful context. They can regulate physical violence by transforming it into a respectful and peaceful socio-emotional encounter with all participants.

The traditional sporting game of Bear, Guardian, and Hunters. A ritualized socio-affective interaction

The Bear and the Guardian is a traditional game played in different times and societies and is known by various names. Parlebas (2000, p. 8), when studying this game, noted the following denominations: Game of the pivot (paintings of Herculaneum first century after J.C.); game of the nail (Rome, III century after J.C.); the devil in chains in the painting of Brueghel (Antwerp, 1,560); The Poira of Jacques Stella (Paris, 1,657).

The Bear and the Guardian is a game with apparently simple rules that, in reality, gives rise to relatively complex social relations.

The internal logic of the Guardian, Bear and Hunters. The chained role reversal

Analysis of the internal logic of this game identifies three roles associated with different rights and prohibitions that players must obey.

The Bear

A player sits on the ground and is attached to the Guardian by a rope. It is a passive role, as he cannot intervene to avoid Hunter's blows or help the Guardian.

The Guardian

This player takes on this role and connects with the Bear by the end of a rope that he/she cannot release. He/she engages in negative motor interactions (opposition) toward the hunters, whom he/she tries to hit with a handkerchief in one of his/her hands. The Guardian directly opposes a hunter who threatens the Bear and protects the person in the role of Bear through indirect cooperation or positive motor interaction. This interaction is a ternary relationship in which the cooperation of the Guardian with the Bear takes place through the adversary (hunters).

The Hunters

The rest of the players take the role of the Hunter and carry a handkerchief in their hand to hit the Bear's body without the Guardian touching them. Tactical alliances and complicities may arise between the Hunters, but the rules do not establish a formal relationship of solidarity between these players (Parlebas, 2000).

When a Hunter is hit with a handkerchief by the Guardian, that player switches to the Bear role, the Bear moves to the Guardian role, and the Guardian changes to the Hunter role (see Figure 1).

Each role change establishes the end of a sequence of play. The game is a succession of role reversals simultaneously, as this triad is affected by a chained permutation between the Hunter, the Bear and the Guardian. The internal logic favors that the participants can go through all the roles of the game, giving rise to a web of complex social interactions.

Unlike Olympic sports, the rules of the game do not establish a way to end the game. Tiredness, the start of another activity or any other external criteria can be the reason for ending the game. Moreover, this criterion may vary depending on who the players are or the game's conditions.

We are dealing with a small social universe, which gives rise to a singular motor interaction ritual based on an original system of interpersonal motor relations.

The motor conducts of the Bear, Guardian, and Hunters in a chained plot of relationships and emotions

This game activates the dynamism of motor conduct with a strong emotional charge. At the same time, it triggers solidarity and physical aggressiveness, which makes possible the constant adaptation of the players according to the chained change of the three roles (Parlebas, 2000, p. 8).

The rules of this game authorize Hunters' motor aggression on the Bear, as they can hit its back with a handkerchief. We can refer to a lawful motor aggressiveness that corresponds to those motor interactions between opponents whose motor conduct is authorized by the rules (Collard, 2004; Collard and Oboeuf, 2007; Dugas, 2008). On the other hand, players may engage in other motor conducts associated with illicit motor aggressiveness or physical violence when their intervention is harmful and affects the physical integrity of other people (e.g., punching an opponent). Such violence is illegal and, therefore, punishable.

In the past, traditional games incorporated a high degree of motor aggression in the participants' interactions (e.g., soule as a predecessor of today's rugby), who risked getting hurt in the matches. Over time, society has civilized the intensity of interpersonal relations. So now, the conflict between two sides is ritualized in a web of regulated motor interactions, as a sport so well represents. It is the process of civilization of society and of traditional sporting games (Elias, 1987).

The practice of this game does not eliminate aggressive behavior but allows the emergence of aggressive behavior and enables each

FIGURE 1
The roles in the Bear-Guardian and Hunter Game.

student to learn to channel such conduct toward a noble, respectful and peaceful coexistence objective (Loyer et al., 2015). The player can assess the motor aggressiveness of his or her strokes (moderate or intense motor aggressiveness, Collard, 2004) and become aware of the emotional consequences (e.g., fear, sadness, anger, and rejection).

In the set of motor interactions with different levels of motor aggressiveness, collective emotions play a pivotal role in shaping players' responses to conflicting events and in contributing to the evolvement of this social interaction that maintains the emotional climate and collective emotional orientation that they have developed (Bar-Tal et al., 2007).

The Bear, Guardian and Hunters game originates a network of motor interactions ordered under a cycle of ternary permutation between the three roles. In each Role, people can make different decisions and test their socio-motor empathy and the management of their emotions for each Role. Each of the three roles carries different ways of relating and experiencing emotions.

Based on the theoretical framework and the explanations of the contribution of traditional games in general and the Bear-Guardian-Hunter game in particular, this research aimed at the following objectives.

1. To identify whether there are significant differences in the emotional intensity experienced by players in the roles of Bear, Guardian, and Hunter.
2. To recognize the units of emotional meaning arising from participation in Bear, Guardian and Hunter roles.
3. To reveal the correspondence between the positive or negative emotion experienced in the three roles (emotional triad) and the emotional meaning triggered by the Bear, Guardian and Hunter motor interactions.

Method

Design

This research corresponds to a mixed-method study. It contains qualitative and quantitative results that have been integrated to ensure the information mixing (Teddie and Tashakkori, 2010; Anguera et al., 2018).

Initially, the research corresponds to a qualitative, descriptive and interpretative study carried out in natural conditions (Miles and Huberman, 1994; Taylor and Bogdan, 2000; Krippendorff, 2002). In the absence of previous studies on the emotional meaning of motor interactions in this game, it has been necessary to describe the findings (units of emotional meaning in the three roles according to different phases of content analysis of reduction, separation and grouping). It is naturalistic since the experience was conducted under normal conditions, where university students usually participate in practical sessions.

In parallel, the hermeneutic units were arranged in a database to be statistically analyzed (quantizing qualitative data) according to an associative strategy (exploring the functional relationship between variables; Ato et al., 2013). In this case, we explored the statistical relationship between the different hermeneutic units (role, motor interaction and motor aggression) and the emotions experienced in the three roles (emotional triad).

Finally, the study is interpretative in that the results obtained in the content analysis and the quantitative analysis have been interpreted in a mixed methods manner by the theoretical framework of reference (fundamentals of motor praxeology linked to the interaction approach as ritual).

Participants

A total of 131 university students (46 women and 85 men) aged 18–35 years ($M = 20.19$, $SD = 2.42$) on the undergraduate degree in Physical Activity and Sport Science offered by the National Institute for Physical Education of Catalonia (INEFC) at the University of Lleida, Spain, took part in the study. The IRB/Ethics Committee approved the study and Clinical Research (CEIC) of the University of Lleida, and all participants gave their consent to participate.

Instrument and procedure

The 131 participants in this study carried out the intervention in five groups of 25 to 35 people, according to the usual organization of the practical sessions of the subject. We followed the indications described by the CEMEA group in France (Parlebas, 2001) in describing how to carry out this game. According to the rules, at least eight players and a maximum of 13 people can play. In each group, the participants were distributed in two or three zones (groups of up to 26 students in 2 zones; groups of more than 26 people in three zones).

The players participated in this game for 8 min since this is the duration used by the motor action research group (GIAM) in previous studies on other traditional sports games.

After finishing the game, each participant individually answered the validated questionnaire on sports games and emotions GES-II (Lavega-Burgués et al., 2018). This questionnaire expressed the intensity (Likert scale from 1 to 7) experienced in five basic emotions (joy, anger, fear, sadness, rejection). For the emotion registered with the greatest intensity, the reason for that intense value was requested to be described.

Statistical analysis of quantitative data

Descriptive statistics, mean and standard deviation, were calculated for positive and negative emotions by roles. The effect sizes (E.S.) interval of >0.2 small, >0.5 moderate and > 0.8 large were used to interpret the differences calculated according to recommendations (Cohen, 1988).

Content analysis of qualitative data

The qualitative data collected with the GES-II questionnaire were analyzed using the "content analysis" technique to formulate valid, applicable inferences according to the context of the study (Krippendorff, 2002). The analysis enabled categories to be formed using the method developed by Miles and Huberman (1994), which consists of three phases: (1) to reduce, (2) to separate, and (3) to synthesize and group units of socioemotional meaning.

Reduction

Once the comments were transcribed verbatim, the reduction of data into units of meaning was first made deductively, following the theoretical approach of reference. Three significant units were observed for each Role of Bear, Guardian, and Hunter:

a) Role. This unit corresponded to comments referring to the role in general, to the strategies used, without making any explicit comment on the motor interaction (e.g., I felt joy because the role of Hunter was very dynamic; I felt fear because I did not think that I would not change roles; I felt joy because thanks to my strategy I was able to change from the role of Guardian to Hunter).
b) Motor interaction. Comments from this unit referred to cooperative or opposed interactions between the roles (e.g., I was happy that I quickly captured a hunter; I felt sad that the Guardian did not protect me; I felt terrible being captured by the Guardian).
c) Motor aggression. In this unit, the comments described an intense motor interaction between the players associated with motor aggressiveness (e.g., Playing the Role of Bear was not a problem for me, despite receiving some strong blows from the Hunters; I was amused to see the Bear's reaction when he screamed and also laughed when receiving a strong blow to his back).

Separation

Suddenly, through an inductive procedure, the units of meaning were separated so that they could be synthesized for each Role. The units referring to Role, Motor Interaction and Motor Aggression were separated according to two criteria. The first criterion of type of emotion originated two large groups of testimonials referring to emotional well-being (positive emotion of joy) and emotional discomfort (negative emotions, fear, sadness, rejection, anger). The second criterion corresponded to the direct or indirect relationship with the registered unit. They separated into a first group that showed a direct relationship with the observed unit of meaning (e.g., I had a good time spending a short time in the Role of Bear). In the concept map, we identified them with the proposition FOR. The second group corresponded to explanations indicating feeling an emotion despite being in an undesirable situation (e.g., I was fine in the role of the Bear despite having been beaten by the Hunters; I liked the role of the Guardian very much, even though I could not prevent the Hunters from attacking the Bear). In these cases, we identified the comments in the concept map with the expression DESPITE.

Synthesizing and grouping

Finally, we group each Role's meaning units in a concept map. We drew a broken line to express that although this option was not observed, these emotional meanings could be given to other groups of people. In the other cases, the continuous lines showed that this unit had been registered with the participants of this study (see Figures 2–4).

Statistical analysis of qualitative data

For the present study and the purpose of analysis, descriptive and inferential data analyses through crosstabs (Luchoro-Parrilla et al., 2021; Ormo-Ribes et al., 2021) were computed. The Pearson's Chi-square test and Cramer's V (effect size) (Field, 2013) were performed to compare the obtained frequencies according to (Oso_orientacion_emociones/Guardian_orientacion_emociones/Oso_orientacion_emociones/Triada Emo2) with special attention to adjusted residuals (ARs) > 1.96 or < −1.96. The significance level was set at $p \leq 0.05$.

The statistical package SPSS version 25.0 (IBM Corp., Armonk, NY, United States) was used for the analyses. On the other hand, RapidMinner 9.10 was used to uncover association rules between the study variables. The measures observed in the results were support, confidence and lift (Park et al., 2014). Support refers to how often a given rule appears in the database (Support = Freq (X, Y)/N). Confidence measures how often each item in Y appears in an interaction that contains items in X also (Confidence = Freq (X, Y)/Freq(X)). Finally, the lift value (between 0 and infinity) is a measure of the importance of a rule (Support/Supp(X) * Supp(Y)). A lift value greater than 1 indicates that the rule appears more often together than expected. A minimum confidence value was set at (<0.4) to select the association rules.

Figures 5, 6 reflect the intensity of the relationships between variables. While thin or missing lines mean a weak relationship, thicker lines reveal a stronger relationship.

Methodological integrity

The methodology followed has considered the guidelines of Levitt et al. (2018) referred to the Journal Article Reporting Standards for Qualitative Primary, Qualitative Meta-Analytic, and Mixed Methods Research in Psychology. The claims made from the analysis are warranted and have produced findings with methodological integrity. The study followed procedures that supported methodological integrity.

Adequacy of the data

The data was obtained from the comments described by the participants seconds after finishing the game. Each student answered separately to avoid interference. It was made clear that there were no right or wrong answers but that they were different and corresponded to the emotional meaning each person had given to their motor conduct.

Grounded findings in the evidence

The findings correspond to the analysis of the students' texts in their literal versions. The procedure followed is based on evidence obtained in previous studies, some of which were doctoral theses published in various scientific articles of impact. All this has allowed this study to move forward to reveal the phenomenon of the emotional meaning of the game, which is invisible to any observer.

Data quality control

The content analysis followed a rigorous procedure among three researchers that lasted 6 months. Three university students in physical activity and sports sciences with a master's degree in physical education, experts in the discipline of motor praxeology and previous studies on content analysis of emotional states in other games participated. The 90 comments were arranged in a database in excel format. Subsequently, each text was associated with one of the five emotions. Those researchers took part in 40 h of training on content analysis following the guidelines of Anguera and Blanco (2003). This training made it possible to prepare a reference manual in which the criteria and components that each unit of emotional meaning could include were described.

The manual was the result of (1) reducing, (2) separating, and (3) synthesizing and grouping units of emotional meaning. The units of

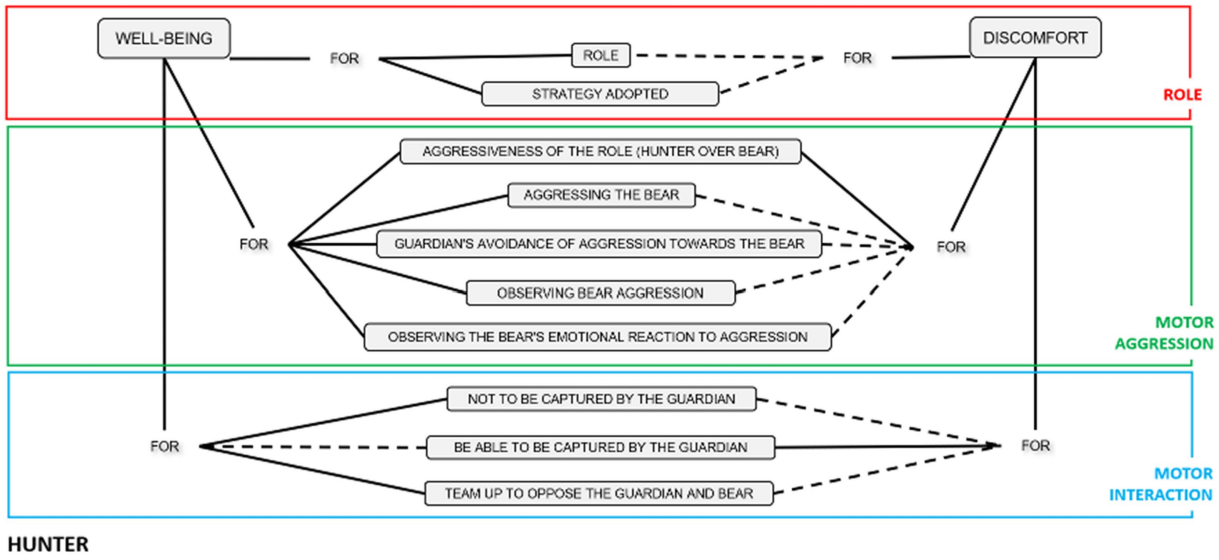

FIGURE 2
Units of emotional meaning in the Bear role.

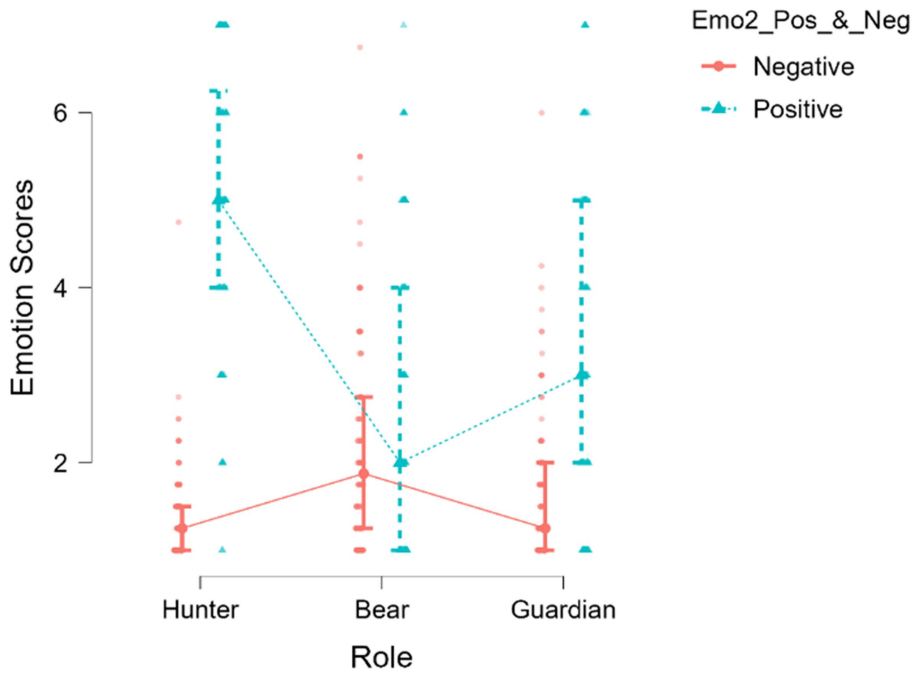

FIGURE 3
Units of emotional meaning in the Guardian role.

meaning created in the manual were reviewed several times in a deductive and inductive way by the three researchers until a final version was obtained. Subsequently, the three researchers performed a pooled analysis of the first 50 comments. Then, each researcher separately analyzed the following 50 comments. Then, possible disagreements were met and discussed until the result of this analysis was unified, guaranteeing complete inter-rater agreement. This procedure was repeated until the analysis of all comments was completed. The units of meaning created in the manual were reviewed several times in a deductive and inductive way by the three researchers until a final version was obtained. Subsequently, the three researchers performed a pooled analysis of the first 50 comments. Then, each researcher separately analyzed the following 50 comments. Then, possible disagreements were met and discussed until the result of this analysis was unified, guaranteeing complete inter-rater agreement. This procedure was repeated until the analysis of all comments was completed.

Cohen's kappa coefficient was applied to measure the level of inter-observer agreement (stability and objectivity). The values ranged from 0.86 to 0.91 (in the first 50 content analysis) and 0.90 to 0.96 (in the other content analysis).

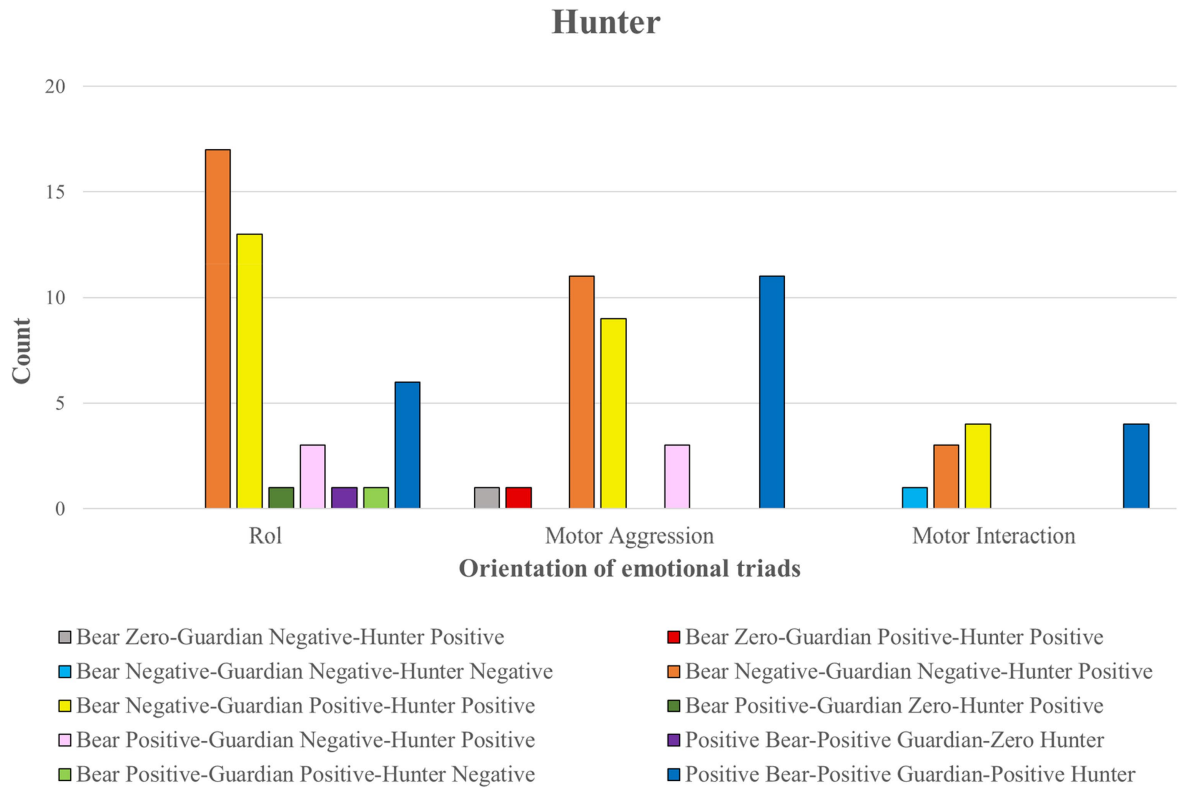

FIGURE 4
Units of emotional meaning in the Hunter role.

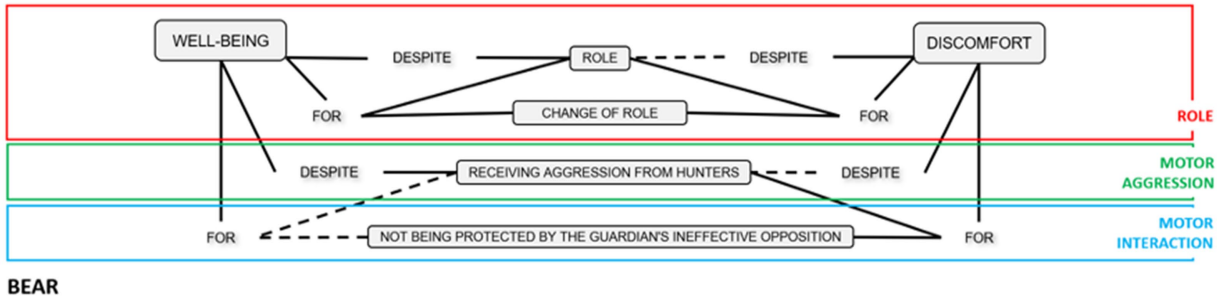

FIGURE 5
Itinerary of the emotional meanings in the three roles. The thickness of the lines corresponds to the frequency of comments. The thicker the lines, the more comments there are.

Results

Emotional intensity in the Bear, Guardian, and Hunter roles

The statistical analysis showed that in the three roles, the positive emotions were more intense than the negative emotions (see Table 1). The size of Cohen's effect *d* (ES = Effect Size) of the positive emotions concerning the negative emotions reached high values in the Hunter (ES = 3.09) and Guardian (ES = 1.18) roles. This size was significantly smaller in the Bear role (ES = 0.39).

Positive emotion intensities between roles were also compared. The Hunter role elicited higher values of joy ($M = 5.09$; SD = 1.61) than the Bear role ($M = 2.77$; SD = 1.72) (ES = 1.39 Hunter > Bear). The Hunter role also activated stronger values of Joy than the Guardian role ($M = 3.41$; SD = 1.72) (ES = 0.95 Hunter > Guardian). The values of joy were also more intense when comparing the Guardian role with the Bear role (ES = 0.35 Guardian > Bear).

Comparing the intensity of negative emotions also found significant differences between the three roles. The Bear role produced more intense negative emotions ($M = 2.17$; SD = 1.25) than the Hunter role ($M = 1.38$; SD = 0.53) (ES = 0.82 Bear > Hunter). The role of Bear also raised either higher negative emotion values than the Guardian role ($M = 1.66$; SD = 0.88) (ES = 0.47 Bear > Guardian). Finally, indicate that negative emotions were more intense in the Bear and the Guardian roles for those who originated in the Hunter role (ES = 0.38 Guardian > Hunter).

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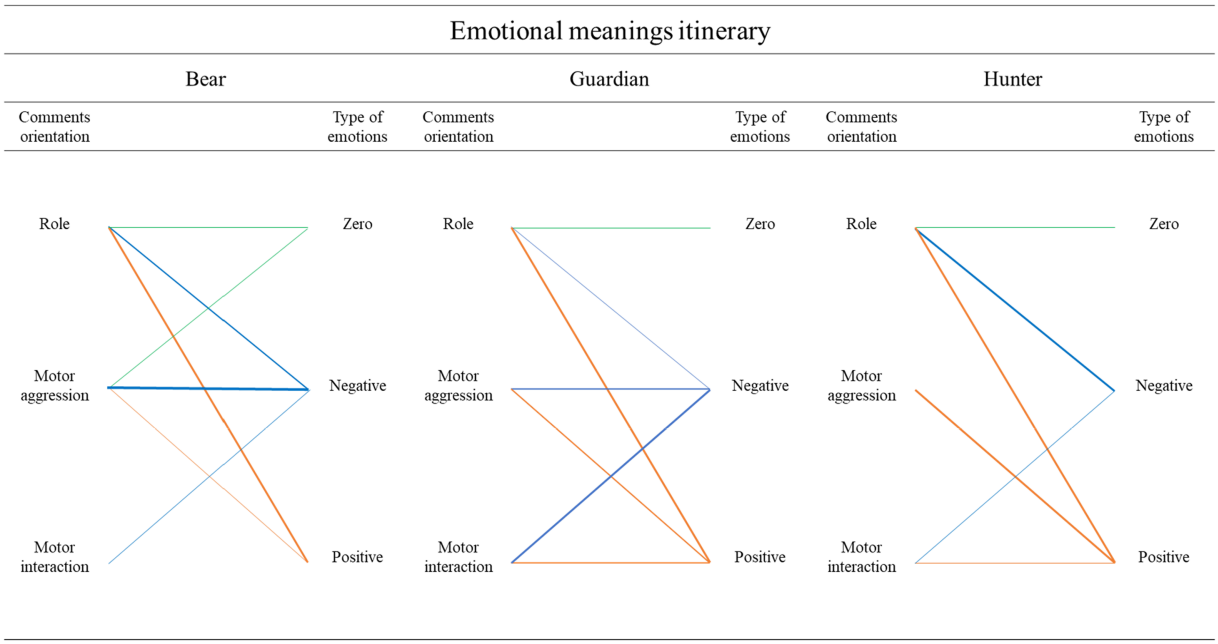

FIGURE 6
Emotional itinerary in the chained roles. The thickness of the lines corresponds to the frequency of comments. The thicker the lines, the more comments there are.

TABLE 1 Positive and negative emotions (mean, standard deviation, and effect sizes) by roles.

Intra-role	Positive emotions	Negative emotions	Effect size (Cohen's *d*)
Bear	2.77 ± 1.72	2.17 ± 1.25	Positive > Negative = 0.39
Guardian	3.41 ± 1.89	1.66 ± 0.88	Positive > Negative = 1.18
Hunter	5.09 ± 1.61	1.38 ± 0.53	Positive > Negative = 3.09

Figure 7 shows the behaviors of the three roles in positive and negative emotional states.

This study explored the emotional meaning attributed to the three roles to provide quality in the findings of the statistical treatment. The content analysis of the students' comments identified three main dimensions of emotional meanings in each of the roles, Bear, Guardian and Hunter, referring to (a) the role, (b) motor interaction, and (c) motor aggressiveness. The following sections use concept maps to describe the units of emotional meaning (of well-being or discomfort) for each of these three main dimensions. In the conceptual maps, the continuous lines correspond to the units observed with the participants studied. In contrast while the dashed lines refer to categories that might appear if this study were carried out with other participants.

In a second section, for each role, we show the relationship between the three significant dimensions of emotional meaning (role, motor interaction and motor aggressiveness) and the emotional triads that arise from participation in the three chained roles of this game (Bear: Zero ZB = without an answer; PB = Positive Emotion; NB = Negative Emotion; Guardian: Zero ZG = without an answer; PG = Positive Emotion; NG = Negative Emotion; Hunter: Zero ZH = without an answer; PH = Positive Emotion; NH = Negative Emotion).

Units of emotional meaning in the Bear role

The role of the Bear mostly gave rise to negative emotions, although some people also highlighted the emotion of joy.

Players in the role of Bear expressed discomfort at not being able to change roles. On other occasions, emotional well-being was felt when the role change occurred quickly. The discomfort could also be due to not being protected by the ineffective strategy of the Guardian. Likewise, players in the Bear role expressed discomfort when receiving motor aggression from the Hunters. Surprisingly, some people expressed joy in the game, despite receiving aggression with the hunters' handkerchief.

Relationship of emotional meaning with the emotional triad in the Bear role

The 90 comments on the role of Bear included testimonies related to the emotional meaning of the role ($n = 45$) and motor aggression ($n = 44$). In contrast, only one comment was associated with the emotional meaning of motor interaction.

Three triads stand out from the 10 possible emotional triads due to the positive or negative emotion in each of the three roles (see Figure 8). Two triads with negative emotions for the bear ON_GN_CP (orange color) ($n = 31$ comments), ON_GP_CP (yellow color) ($n = 26$ comments); and one triad with positive emotions for the three roles OP_GP_CP (dark blue color) ($n = 21$ comments).

The two bear well-being triads corresponded to comments associated with the emotional meaning referred to the role (testimonies expressing joy at being able to change from the role of Bear to another

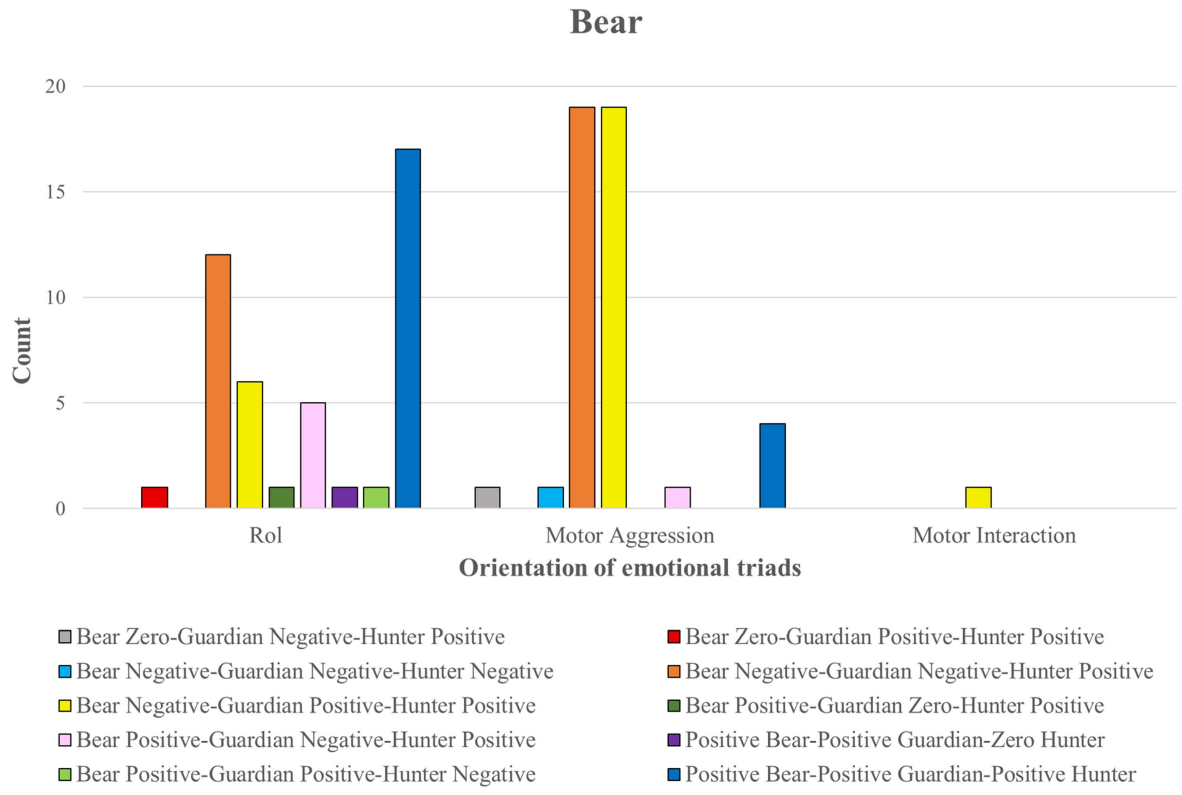

FIGURE 7
The intensity of positive and negative emotions in the Bear, Guardian, and Hunter roles.

more favorable role). Emotional triads linked to a negative experience of the Bear were frequent in comments oriented to the emotional experience of motor aggression.

The cross-table statistical test relating the three types of comments (role, motor interaction and motor aggression) to the emotional triads found no significant differences ($p = 0.069$; *Cramer's V* = 0.39). However, some trends of interest were observed in three emotional triads.

The triad OP_GP_CP (dark blue color) was represented by 21 comments referring to the emotion of joy in the role of Bear. Most of these comments ($n = 17$; *residual fit* = 3.4) referred to the role. Relating these results to the emotional map shown above (see Figure 8), it can be deduced that these are emotional states of well-being elicited by being able to change roles. On other occasions, despite being in this role, players report feeling joy.

> *"It was a fun role; even though we got beaten up, we were laughing, and so I had a good time".C1*

We identified four comments from this emotional triad referring to motor aggression. Statistical analysis indicates that these comments were less present than expected (*residual adjustment* = −3.2). In this case, testimonies reported feeling joy despite receiving motor aggression actions from the hunters.

> *"Joy because I was having a good time, even though I was being punished" C2*

This triad did not originate comments referring to motor interaction.

The emotional triad ON_GP_CP (yellow color) gave rise to 26 comments represented by negative emotional meanings in the role of Bear. Most comments ($n = 19$) expressed the discomfort originating from the motor aggressiveness (being hit with the scarf by the hunters). The statistical test shows more comments than expected (*residual fit* = 2.8).

> *"I felt angry because of the blows I received" C3; "I felt fear because I did not want to be hit too hard" C4.*

This emotional triad only gave rise to 6 comments of emotional discomfort referring to the role (for playing an uncomfortable role in this game and being unable to change roles until the Guardian touched a Hunter). The statistical test tended to observe fewer comments than expected (*residual adjustment* = −3.1).

The emotional triad ON_GN_CP (orange colour) gave rise to the highest number of comments ($n = 31$), although the trends were not significant. Most comments were directed at motor aggression ($n = 19$; *residual fit* = 1.6) and role ($n = 12$; *residual fit* = −1.4).

> *"Being hit, you are afraid of being hurt" C5.*

Units of emotional meaning in the Guardian role

The 90 comments that originated from the Guardian role were related to the three dimensions of emotional meaning, i.e., role, motor interaction, and motor aggressiveness.

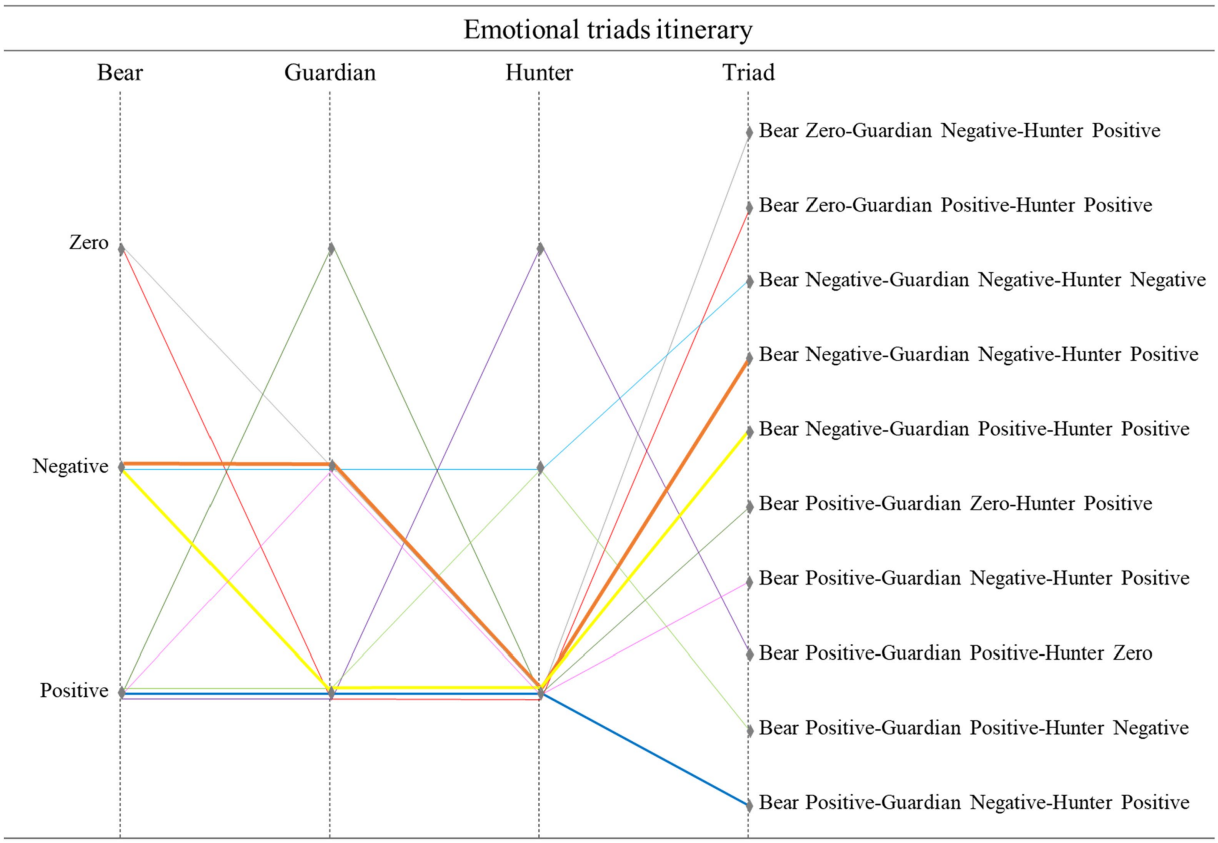

FIGURE 8
Orientation of emotional triads in the Bear role.

In the role dimension, the Guardian expressed a sense of well-being because of the attributes of this role and its dynamism in changing roles. On the other hand, some people expressed discomfort with the characteristics of this role (the Guardian has to keep an eye on the Hunters and the Bear).

In the motor interaction dimension, well-being was associated with the possibility of catching the Hunters or in the very act of catching him. It showed discomfort when the Guardian had difficulties in capturing a Hunter.

Concerning motor aggression, there was a predominance of comments of discomfort when faced with the responsibility of preventing the Bear from being attacked by the Hunters or for not being able to prevent it. The Guardian also expressed discomfort at not wanting to attack the hunters. Other people show well-being by preventing the Bear from being aggressed. It is observed that intervention in this role, and the game in general, favors well-being even if aggression is not avoided.

Relationship of emotional meaning with the emotional triad in the Guardian role

In contrast to the Bear role, the 90 emotional comments in the Guardian role had a similar distribution across the three dimensions of emotional meaning: motor interaction ($n = 37$), motor aggressiveness ($n = 27$) and role ($n = 26$). Three emotional triads stand out, of which only one expresses emotional distress in the Guardian role (ON_GN_CP; orange color). The other two triads are associated with comments referring to the emotion of joy that participation in this role arouses (OP_GP_CP; blue color; ON_GP_CP; yellow color).

The cross-table statistical test relating the three types of comments (role, motor interaction and motor aggressiveness) to the emotional triads found significant differences ($p = 0.041$; *Cramer's* $V = 0.41$; see Figure 9).

The emotional triad ON_GN_CP (orange color) was associated with 31 comments referring to negative emotions in the role of Guardian. Significant differences were observed in words referring to motor interaction ($n = 19$; *residual adjustment* = 2.8). These comments described the discomfort of not being able to catch the hunters.

> *"Sometimes I could not catch the hunters, and I felt bad "C5.*

Secondly, 10 comments referring to motor aggression were found. However, no significant differences were found (*residual fit* = 0.3). These comments referred to the discomfort of not wanting to attack the Hunters, not avoiding aggression toward the Bear and the responsibility of not avoiding aggression.

> *"I felt anger at having to defend the person who has the role of the bear. In other words, if I didn't do my job properly, the person inside got hit a lot because of me". C6*

Finally, there were fewer comments than expected, referring to the role ($n = 2$; *residual adjustment* = −3.4). These testimonies described emotional discomfort at being unable to change roles and being in a role they did not like.

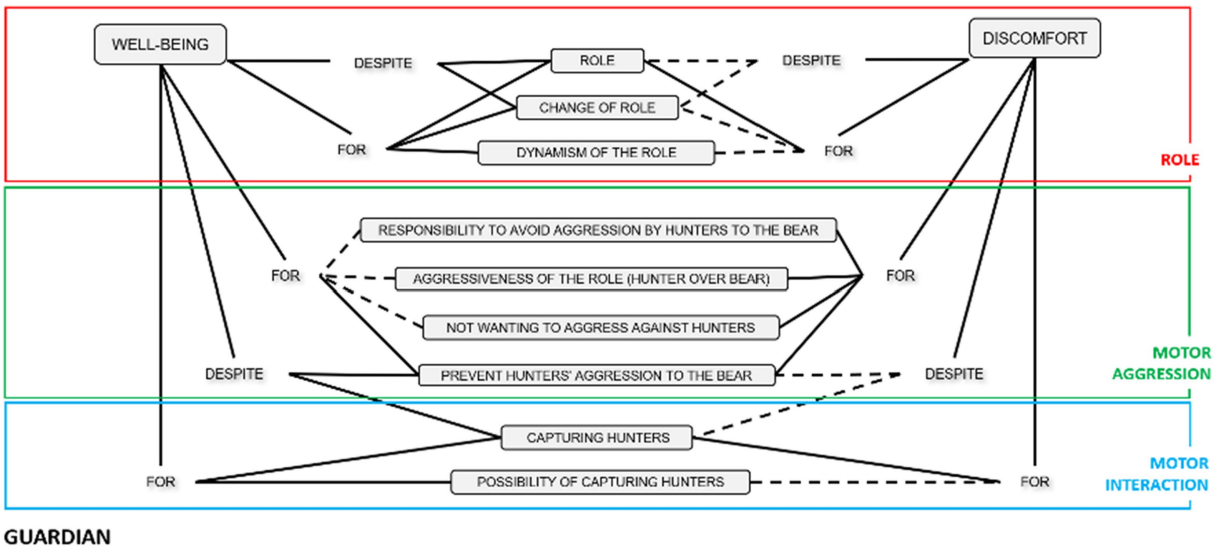

FIGURE 9
Orientation of emotional triads in the Guardian role.

The emotional triad ON_GP_CP (yellow) gave rise to 26 comments referring to the emotion of joy in the role of Guardian. Of these comments, significant differences were observed only in words referring to the role being more present than expected ($n = 19$; *residual adjustment* = 2.8). The testimonies highlighted the joy of the characteristics of this role, its dynamism and ability to change roles.

> *"I felt joy at the thought of how close I was to be able to change my position to that of a hunter" C7.*

Thirdly, the emotional triad OP_GP_CP (dark blue) generated 21 comments on emotional well-being. Only the comments referring to motor aggression caused significant differences. A higher number of words were recorded than could be expected ($n = 10$; *residual adjustment* = 2.0). These comments highlighted joy at chasing or at the capture of the Hunters.

> *"I felt joy because it was funny and amusing how the others were trying to run away so I would not hit them" C8*

Units of emotional meaning in the Hunter role

The 90 comments collected in this role originated emotional meaning units referring to the three dimensions: role, motor interaction and motor aggressiveness.

In the role dimension, emotional well-being originated from this role's characteristics and the strategy adopted.

In the motor interaction dimension, joy was present among the Hunters who avoided being captured by the Guardian and for opposing both the Guardian and the Bear as a team. Negative emotions originated from the possibility of being caught.

In the dimension of motor aggression, emotional well-being arose from attacking the Bear by observing how other Hunters beat him and his emotional reaction when he was assaulted. Emotional discomfort in this dimension arose due to the aggressiveness of the role of the Hunters on the Bear.

Relationship of emotional meaning with the emotional triad in the Hunter role

The 90 emotional comments of the Hunter Role mainly referred to the emotional meaning dimension of the Role ($n = 42$), followed by the testimonies referring to motor aggressiveness ($n = 36$) and lastly to motor interaction ($n = 12$).

As in the other roles, participants in the Hunter role experienced three emotional triads corresponding to joy. ON_GN_CP (orange color); ON_GP_CP (yellow color); and OP_GP_CP (blue color; see Figure 10).

The cross-table statistical test relating the three types of comments (role, motor interaction and motor aggressiveness) to the emotional triads showed significant differences ($p = 0.046$; *Cramer's V* = 0.46) for the triad OP_GP_CP (dark blue color). This triad was associated with 21 positive comments, of which only six comments referring to the role were significant (*residual adjustment* = −1.9). The statistical test indicates that more comments were expected to have been recorded. These comments described joy about the characteristics of the Hunter role and satisfaction with the strategy adopted.

> *"I was happy because it favored other teammates being able to attack the bear when I pushed the Guardian away". C9*

Although no significant differences were found, 11 comments were recorded that expressed well-being when participating in motor aggression (by attacking the Bear, by observing how the Hunters attacked the Bear and their emotional reaction), and when the Guardian prevented aggression from other Hunters).

> *"Because it was funny to see the reactions of the bear when we were going to hit him".C10*

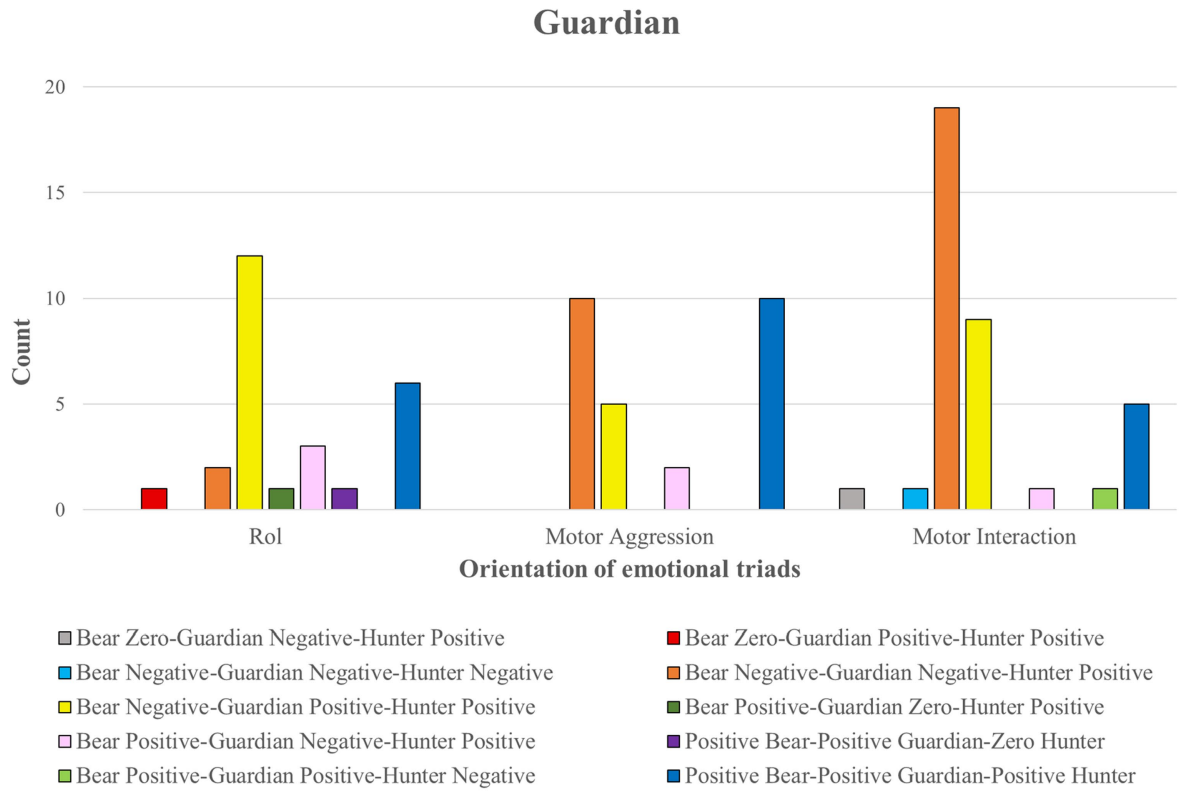

FIGURE 10
Orientation of emotional triads in the Hunter role.

The emotional triad ON_GN_CP (orange) elicited the highest number of comments (n = 31). Although no significant differences were found, there was a tendency for emotional well-being to refer mainly to a role ($n = 17$) and motor aggression ($n = 11$).

> *"The most intense emotion was joy because it was the most 'fun' role". C11.*

The other emotional triad ON_GP_CP (yellow) behaved similarly to the previous one ($n = 26$). Although no significant differences were found, there was a tendency for emotional well-being to refer to role characteristics ($n = 13$) and motor aggression ($n = 9$).

> *"It has given me much joy to be able to hit my partner in the middle" C12*

The itinerary of emotional meanings in each of the three roles

Figure 5 shows the relationship between the emotional orientation of the three groups of comments (role, motor interaction and motor aggressiveness) for each role (Bear, Guardian, Hunter). The emotional meanings gave rise to emotional triads with a chained emotional orientation for each role (no value = OC; GC; CC; positive emotion: OP, GP, CP; negative emotion: ON, GN, CN). A greater thickness of the lines linking comments to emotions indicates greater frequency.

Each role gives rise to emotional singularities for the different dimensions of emotional meaning.

The role dimension elicited a thick line toward the three emotional options in each of the roles Bear (OC, ON, OP), Guardian (GC, GN, GP), and Hunter (CC, CN, CP).

The motor interaction dimension gave rise to a weak line of negative emotion in the Bear (ON). It elicited two thick lines of positive and negative emotion in the roles of Guardian (GP, GN) and Hunter (CP, CN).

The motor aggressiveness dimension projected three thick solid lines in the Bear role (OC, OP, ON), two thick lines of positive and negative emotion in the Guardian role (GP, GN) and one thick line of positive emotion in the Hunter role (CP).

The emotional itinerary in the chained role changes

Figure 6 shows the emotional pathway expressed by the players during the game. The lines connect the type of emotion described in each role, and the emotional triad felt. The greater the thickness of the lines, the more frequently the connection occurred. The thickest links were ON_GN_CP (dark blue), ON_GP_CP (orange), and OP_GP_CP (green).

It can be seen that the most intense lines are associated with positive emotions that originated from a total of 17 branches (Bear = 3, Guardian = 3, Hunter = 3, and Triads = 7). This situation is followed by negative emotions with nine ramifications (Bear = 2, Guardian = 3, Hunter = 2, and Triads = 2). Finally, zero values originate five ramifications (Bear = 2, Guardian = 1, Hunter = 1 and Triads = 1).

The association rules between emotional meanings and emotional triads

Using statistical procedures, we identified the 14 rules of association between the emotional meanings of the roles Bear, Guardian and Hunter, referring to the emotional meaning related to the role, motor interaction, motor aggressiveness and emotional triads (see Table 2).

Figure 11 highlights four significant groups of association rules with different meaning paths and emotional triads. In some of the highest values of support as a percentage of frequencies between the antecedent (premises) and the consequent (conclusion), confidence (< 0.04) corresponding to the effectiveness of the rule since the first requirement is met, that is, the appearance of an antecedent (premises) and lift (relative to the confidence of the rule concerning the consequent).

In the first emotional pathway (group 1 of association rules) of Figure 11, the emotional meanings of the Bear to aggression were linked to rule 3 (*confidence value* = 0.422; *high lift value* = 1.46), subsequently associated with the emotional triad Bear Negative-Guardian Positive-Hunter Positive. Finally, rule 14 (which obtained the highest confidence value of 0.731 and a high lift value of 1.46) was associated with motor aggression toward the Bear.

In the second emotional pathway (group 2 of association rules), the Bear's emotional meanings of aggression were related to rule 5 (*confidence* = 0.47), which were then associated with the emotional meanings of the Hunters' aggression. They were then associated with rule 10 (*confidence* = 0.58) and finally with the Bear's emotional meanings of motor aggression.

In the third emotional itinerary (group 3 of association rules), the emotional meanings of the Bear to aggression were related to rule 1 (*confidence* = 0.422), then associated with the emotional meanings of the role-referred hunters. Two possible associations were then presented:

1. Through rule 9 (*confidence* = 0.548), and then with the emotional role-related meanings of the Bear. Then it was related to rule 7 (*confidence* = 0.523) to address the emotional role-related meanings of the hunters again.
2. Through rule 4 (*confidence* = 0.452), this itinerary returned to the Bear's emotional meanings of motor aggression.

All the rules associations were connected in the fourth emotional pathway (group 4 of association rules). The emotional meanings of the Bear in the face of aggression were related to the Guardian concerning motor interaction through rule 8 (*confidence* = 0.533 and the highest *value of support* = 0.27) and rule 13 (which registered a high confidence value of 0.649 and the highest support value of 0.27).

Moreover, the Guardian concerning motor interaction was also related to the emotional triad Bear Negative-Guardian Negative-Hunter Positive by rule 6 (*confidence* = 0.514; *lift* = 1.491and rule 12 (with a high confidence value of 0.613; with a high lift value of 1.49).

The Bear Negative-Guardian Negative-Hunter Positive emotional triads were connected by the Bear's emotional meanings of aggression by rule 11 (*confidence* = 0.613; *lift* = 1.226) and rule 2 (*confidence* = 0.211; *lift* = 1.226).

Discussion

The present research aimed to study the emotional intensity in the roles of Bear, Guardian and Hunter, as well as the units of emotional

TABLE 2 Pairwise association rules (premises and conclusion) for emotional meanings and emotional triads (according to support, confidence <0.04 and lift indicators).

No.	Premises	Conclusion	Support	Confidence	Lift
1	Bear motor aggression	Hunter role	0.211	0.422	0.905
2	Bear motor aggression	Bear negative-guardian negative-hunter positive	0.211	0.422	1.226
3	Bear motor aggression	Bear negative-guardian positive-hunter positive	0.211	0.422	1.462
4	Hunter role	Bear motor aggression	0.211	0.452	0.905
5	Bear motor aggression	Hunter motor aggression	0.233	0.467	1.167
6	Guardian motor interaction	Bear negative-guardian negative-hunter positive	0.211	0.514	1.491
7	Bear role	Hunter role	0.256	0.523	1.120
8	Bear motor aggression	Guardian motor interaction	0.267	0.533	1.297
9	Hunter role	Bear role	0.256	0.548	1.120
10	Hunter motor aggression	Bear motor aggression	0.233	0.583	1.167
11	Bear negative-guardian negative-hunter positive	Bear motor aggression	0.211	0.613	1.226
12	Bear negative-guardian negative-hunter positive	Guardian motor interaction	0.211	0.613	1.491
13	Guardian motor interaction	Bear motor aggression	0.267	0.649	1.297
14	Bear negative-guardian positive-hunter positive	Bear motor aggression	0.211	0.731	1.462

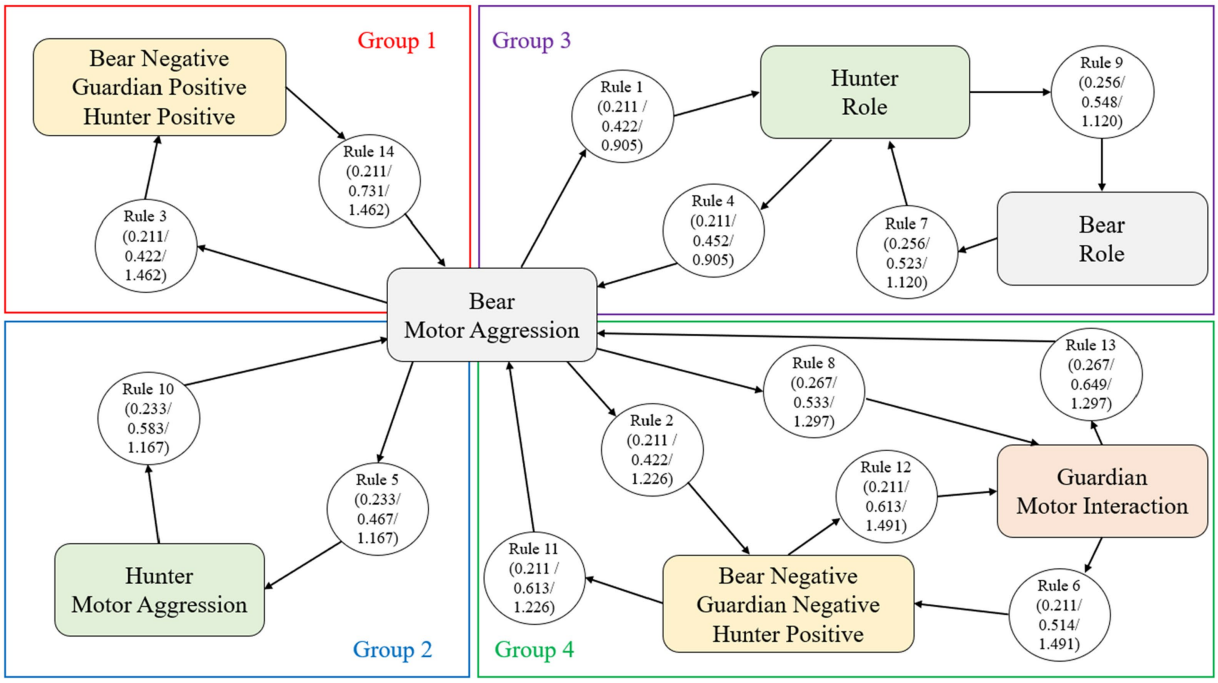

FIGURE 11
Emotional itineraries (groups of association rules) based on the emotional meaning of the Bear associated with Motor Aggression by support, confidence and lift measures.

meaning and their correspondence with the emotional triad in the three roles.

The data obtained confirm that the ritual order that establishes the motor interactions of this game is associated with the constant chained change of roles, which also involves the relationships between the players and their emotions.

The first finding shows that in all three roles, the players experience, above all, positive emotions. However, statistical evidence reveals that each role carries unequal emotional experiences. Positive emotions achieve the highest intensity in the Hunter role and less in the Bear role.

Negative emotions are highest in the Bear role and lowest in the Hunter role. The Guardian occupies an intermediate position, both in positive and negative emotions.

To contextualize and interpret this first finding, it is it is necessary to go beyond the quantitative data. Thus, to unveil the meaning of emotional intensity, it is necessary to know why players feel different intensities of emotions in this ritual of singular motor interactions. Hence, in the content analysis of the players' testimonies in the three roles, emotional meanings associated with the role, motor interaction, and motor aggressiveness have been identified. In addition, using other statistical tests leads us to affirm that each role contains unique socio-affective traits intertwined with the rest of the roles. The Bear, the Guardian and the Hunter originate a chained role change, in which the three roles provide feedback, need each other and complement each other in this socio-affective warp of interdependent relationships. Hence the interest in considering the emotional triads as an indissoluble unit of the effects of the game.

The analysis of the testimonies proves that the relationship with time is one of the critical pillars on which the internal logic of this game rests (Parlebas, 2001). The game leads the participants to change roles and relationships constantly. It is an interactive ritual in which who was a friend becomes an enemy or vice versa.

Unlike sports, the rules of this game do not establish how it ends. The game gives rise to a cyclical, non-causal, purposeless time (Rosenblueth et al., 1943), an open time (Suits, 1978). There is no final scoreboard, and there are no winners or losers, so when the game ends, the participants will not be ordered hierarchically, as in sports (Etxebeste et al., 2014).

The emotional meanings for each role show that well-being or discomfort may be associated with remaining more or less time than desired in each of these roles, i.e., that the temporal flow of the game, with greater or lesser speed, originates the dynamics of role changes.

The role of bear. Well-being subordinated to socio-affective power relations

Statistical evidence reveals that the Bear plays the central role in the game. Emotional meanings refer to motor aggression working like a magnet that attracts four itineraries of rules of meaning association and emotional triads.

This role cannot generate motor interactions, as is evident from the virtual absence of comments on this dimension. The Bear is sitting on the floor with a passive attitude. Its emotional states depend on the following: (a) the speed with which the change of role occurs, (b) the intensity of the motor aggressions received by the Hunters, and (c) the protective efficacy of the Guardian.

Playing the role of the Bear involves receiving motor aggression and experiencing triads of negative emotions in this role while simultaneously eliciting positive emotions in the Guardian and the

Hunter. When the emotional significance is directed exclusively at the Bear role, the rest of the players, in general, can experience positive emotions, contextualizing this fact in the course of the game.

Going through this role requires a good dose of resilience. An opportunity to learn to adapt intelligently to the adverse situations and threats this role receives, putting the necessary self-esteem, courage, hope and patience to the test.

> *"Because I knew I would only be there for a short time, I would close my eyes and listen to the laughter of my colleagues in the hope of changing roles" C13.*

The Bear also needs to adapt to accept with resignation the beatings he/she receives from the Hunters, as the rules do not allow him to intervene.

> *"I felt discomfort as they are hitting you, and you cannot fight back" C14.*

Finally, the Bear needs to cultivate trust and hope with the Guardian. This role generates the expectation that the Guardian will protect her/him, according to the internal logic of this game, with an attitude of respect, understanding and generosity.

> *In the role of the Bear, I was hoping that the Guardian would not take too many risks to catch the Hunters and, therefore, not receive too many hits.C15*

The Guardian role. Well-being in the face of the responsibility to orientate motor interactions toward power and/or status

In the role of Guardian, 12 units of meaning have been identified, of which the majority (67%) refer to relationships with others (8), referred to motor aggressiveness (5) and motor interaction (3).

The testimonies indicate that the Guardian is the most dynamic role with the highest level of responsibility for the players, as he is the only player who, by being effective in his actions, will provoke a change between the three roles.

> *"You feel a bit of adrenaline and excitement of wanting to get everywhere, and no one touches the Bear and continually making decisions". C16*

When adopting an empathic strategy with the Bear, the Guardian engages in "status" interactions (Kemper, 1981) to protect the Bear. She/he weighs up the risk to the Bear in his/her relationship with the space. The Guardian chooses to move just far enough away from the Hunters closest to the Bear to come back when they are attacking her/him or very close to her/his position. Moreover, when he/she can hit a Hunter, he/she does not do so with intensity. The game's internal logic activates socio-motor empathy processes (Parlebas, 2001), which involves abandoning one's point of view and putting oneself in the place of the other participants. Empathic motor conduct includes a cognitive load (appreciation of distances, estimation of chances of success), and an affective engagement (perception and management of emotions in a risky situation) (Parlebas, 2001).

> *"I was happy because I caught it quickly, and my Bear hardly got hit" C17.*

The burden of responsibility, coupled with a lack of effectiveness (self-relatedness), intense beatings of the Bear (Hunter-Bear relationship) and intense motor aggression on a Hunter (Guardian-Hunter relationship), can cause emotional distress.

> *"Anger because the Hunters were attacking the Bear, and that did not seem right to me. I wanted to avoid that situation because I was giving an advantage to Hunters to hit the Bear" C18.*

On other occasions, the Guardian engage in social rituals of power (Kemper, 1981), prioritizing their interests (wanting to change roles) and the will to dominate (capture) the Hunters. This orientation can lead to prioritizing their interests, even if it means exposing the Bear's protection and decreasing levels of solidarity or sociomotor empathy (Parlebas, 2001).

> *"It was fun; you were just worried about catching people". C19*
>
> *"I had to hit my partners so I could change roles; that made me happy" C20*

The role of hunter. The pleasure of starring in power motor interactions

The role of the Hunter is who gives rise to the greatest number of emotional triads of well-being, even if they involve negative emotions for the Bear and the Guardian. Players like this role in general and the variety of strategies it elicits and can be adopted.

This role is responsible for the game's main social motor power interactions (Kemper, 1981). Each Hunter decides the level of motor aggression that will or will not punish the Bear.

This role tests Hunter's civilizing process of self-control of emotions (Elias, 1987), whose success (well-being) is associated with the Bear's failure and pain (discomfort). After deciphering the exchange of emotional meanings with the others, the Hunter can decide whether to try to dominate the Bear and the Guardian or to seek an exchange of motor interactions that satisfies his/her needs and those of the others.

> *"The most intense emotion was fear, as I was afraid of hitting the Bear too hard and hurting him/her".C21*

In this role, people have to channel violent and aggressive behaviors and can transform them into cordial and respectful relationships. Aggressive motor conduct (Collard, 2004; Collard and Oboeuf, 2007; Dugas, 2008) can be transformed into care, protection and respect for the person in the Bear role (Loyer et al., 2015). Players can promote moral order through motor behaviors that are honorable, dignified and respectful of this ludomotor encounter (Goffman, 2004; Parlebas, 2016).

When power interactions predominate, some Hunters feel emotional well-being when attacking the Bear. When power interactions predominate, some Hunters feel emotional comfort in attacking the Bear. It has been observed that some players hold the scarf by both ends with both hands, twisting it in circles to tighten the handkerchief and hit the Bear hard.

Some people express well-being by acting as a team, adopting a collective strategy. This situation involves changing the motor communication network presented by the game's rules. It moves from the confrontation Team against the rest (Bear-Guardian vs. Hunters) to a confrontation between two teams (Team Bear-Guardian vs. Team Hunters; Parlebas, 2001). The superiority and dominance of the Hunters over their opponents, i.e., the interaction of power is accentuated.

> *"I was happy to be a hunter because I had the same goal as my colleagues, and we could collaborate or help each other. Having a 'team' made me feel happy".C22*

Other Hunters may orient their motor behaviors toward status motor interactions. In these circumstances, the emotional meaning is a testament to their sociomotor empathy.

> *"I felt happy because I could hit my colleagues in a friendly way without hurting them". C23*

Often, the Hunter expresses discomfort at the aggressiveness of some Hunters toward the Bear.

The hunters showed little empathy for the person being whipped (the Bear). Some people did not control the force or the place where they hit (face, for example) and were going to harm.

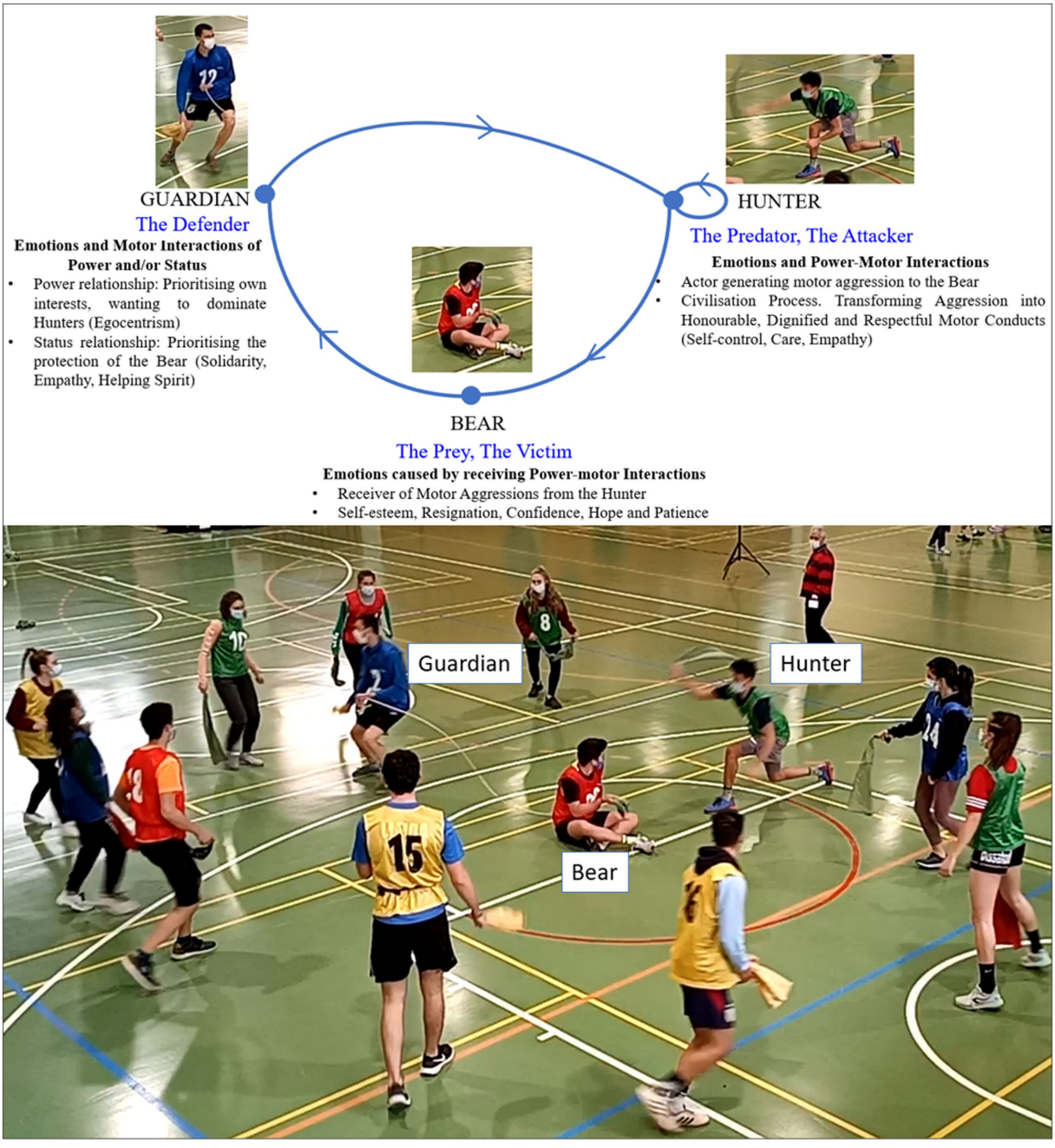

FIGURE 12
The chained role changes network. Emotions and status/power motor interactions. The line represents the change of role. The dot corresponds to the role. The loop over the Hunter role shows that when a role change occurs, some players remain in the same role, as only one hunter changes to the Bear role.s

Equally, there is joy in observing that the Guardian avoids motor aggression toward the Bear. Moreover, in lighthearted situations, the Bear's emotional reaction (e.g., laughing or shouting jocularly) can also be a source of satisfaction.

> *"Because I was amused to see the Bear's reactions when we were going to hit him/her".C25*

Conclusion

The Game of Bear-Guardian and Hunters is an authentic laboratory of interpersonal relations and emotions (Parlebas, 2001). It is a traditional sporting game associated with a unique motor communication network.

This game contains a ritual that organizes and orders the relationships between people and how emotions are expressed and managed. Players share a constant flow of emotional energy. When the plot is cordial and pleasurable, people's emotions enter into states of reciprocal consonance (Collins, 2009). In this way, the practice of this traditional game triggers the literacy of "feeling rules" (Hochschild, 1979).

It is a game that contains several games or sets of socio-affective experiences for each role. At the end of the game, each person takes away a set of subjective emotional meanings that give rise to unequal emotional triads, depending on their intervention in this web of interlinked roles. Each person prioritizes social motor interactions of status or power during the game. Resilience, confidence, and resignation, combined with protection, social-motor empathy and mastery, are processes that people need to adapt to and internalize to play.

The methodology revealed part of this game's secret code (intimate and subjective). The affectivity invisible to external observation can be unveiled through the testimonies of the participants. The comments confirm that this game, if used well, can be an extraordinary tool to foster quality physical education (UNESCO, 2016) and to promote sustainable development (United Nations (UN), 2015). Players must adapt to a holistic understanding of their own and others' well-being to play better.

The time that runs in a role depends fundamentally on the others and the motor interaction they decide on; it will trigger the continuation of the actors' itinerary, which is determined by the game's internal logic. Based on a spatio-temporal relational ritual, the role changes in the game of the Bear-Guardian and Hunters thus appear as true revelators of the socio-emotional experience.

People participating as players through their motor conduct systemically activate their whole personality. When playing, each person attaches unique meanings to the decisions, relationships, emotions and organic aspects of playing each role.

After each change of role, a new adventure begins, a new project and a new web of meanings of motor interactions of status or power (Kemper, 1981). The social ritual starts all over again, and this is how the players reinstate a particular way of relating to each other as people did several centuries ago. We are dealing with a distinct culture expressed through motor conduct. Bodies are cultural signs that teach how to live in a society (Parlebas, 2001), in this case, with the possibility of improving the way of living together.

The Bear, Guardian and Hunters is a proper theater of life in which the actors play and act as a whole, each person integrating meaning into each of the three roles in which he or she is involved (see Figure 12).

With its historical roots going back many centuries, this game offers a perspective that punctuates the civilizing processes (Elias, 1987) followed by humanity. Over the years, the motor aggression of the Hunter over the Bear role has been tempered, civilized, and softened in a process that is not yet finished. Right now, this game in the hands of intelligent, prepared and sustainable teachers could help this democratic process to continue advancing this process of civilization (Elias and Dunning, 1994).

The limitation of this research is that it is based exclusively on the subjective testimonies of the participants. It would be advisable to complement these findings with observational methodology and use other instruments (e.g., accelerometers or GPS) to analyze other dimensions to confirm, contextualize and complement the results obtained.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee for Clinical Research of the Catalan Sports Council (07/2019/CEIGEGC). The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any identifiable images or data included in this article.

Author contributions

PL-B, VA-M, CM-L, and MP: substantial contribution to study conception and design, discussion of data analysis strategies, and writing of the manuscript. PL-B and CM-L: preparation of the document for approval by the ethics committee, and preparation and participation in the empirical work. PL-B, VA-M, and CM-L: content analysis. MP: statistical analysis and preparation of the databases (all variables). All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Chedoke-McMaster attitudes towards children with handicaps scale for traditional sporting games (CATCH-TSG): initial validation in 7 different languages in adult and young populations

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Introduction: Measuring attitudes towards disability is meant to assess which interventions are most likely to create changes in population attitudes. Physical activities, such as Traditional Sports Games, are an excellent methodology to fight against the stigma of disabled people. Thus, the main aim of this study was to validate the Chedoke-McMaster Attitudes towards Children with Handicaps Scale (CATCH) adapted to a physical activity environment.

Methods: Additionally, we implemented this process in a combined way, 7 languages and 2 versions (adult and youth) at the same time.

Results: The results showed that the CATCH-TSG scale provides the scientific community with a valid and reliable tool for professionals who want to assess the change in attitudes towards people with disabilities after receiving a psychoeducational intervention that includes physical activity (TSG).

Discussion: Researchers will compare respective results from different countries and ages using different versions of the scale, jointly validated.

KEYWORDS

stereotype, attitude, disability, social inclusion, cultural diversity

1. Introduction

1.1. Persons with disabilities make up the world's largest and most disadvantaged minority

People with disabilities remain amongst the most marginalized in every society. Over 650 million persons around the world live with disabilities. Persons with disabilities make up the world's largest and most disadvantaged minority, in most parts of the world, there are deep and persistent negative stereotypes and prejudices against persons with certain conditions and

differences. These attitudes determine who is considered to be a person with a disability and perpetuate the negative image of persons with disabilities (UN, 2007, p.3).

Nowadays, discrimination and negative stereotypes pose significant obstacles to the full participation and equity of individuals with intellectual disabilities in society. The transformation of stereotypes related to individuals with intellectual disabilities requires global, national, and local actions. International guidelines provide guidance and frameworks for transforming stereotypes targeting individuals with intellectual disabilities. The UN's Agenda 2030, with its 17 Sustainable Development Goals (SDGs), prioritises promoting inclusion, equal opportunities, and eliminating discrimination against individuals with intellectual disabilities. SDGs 4, 8, and 10 prioritise ensuring inclusive, equitable, and quality education, free from stereotypes. The International Convention on the Rights of Persons with Disabilities (CRPD), adopted by the UN General Assembly in 2006, sets out the fundamental human rights of people with disability and had the purpose to promote, protect and ensure the full and equal enjoyment of all human rights and fundamental freedoms by all persons with disabilities, and to promote respect for their inherent dignity. CPRD emphasises the need to change attitudes and negative stereotypes towards individuals with disabilities, including intellectual disabilities.

1.2. Stereotypes referred to people with intellectual disabilities

Stereotypes and attitudes are synonyms when they refer to a specific social group. Eagly and Mladinic (1989) defined attitudes as the tendency to evaluate an entity with a certain degree of favour or disfavour. These same authors, joint with more recent ones (Bohner and Dickel, 2011; Crano and Gardikiotis, 2015), assume that attitudes should be understood as stereotypes when the entity is a social group. Thus, a stereotype is a tendency to evaluate a social group with a certain degree of favour or disfavour.

According to the World Health Organisation, disability is an impairment in a person's body, mental structure or function, significantly limits in his/her activities (WHO, 2001). These obstacles do not allow disabled people to participate in normal daily activities (WHO, 2001). And finally, the participation restrictions are usually linked to stereotypes that non-disabled people have about them (WHO, 2001). Hence, attitudes (stereotypes) towards disabled people are a core concept of disability.

Crano and Gardikiotis (2015) and Eagly and Mladinic (1989) propose that attitudes (or stereotypes when we speak about a social group) are composed of interaction of cognitive, emotional, and behavioural factors. The first author to propose this model was Triandis (1971). Cognitive variables are related to the beliefs regarding the social group. Emotional factors come from the emotional experiences that the person has with people from the social group. Besides, this factor is also related to our estimations regarding how people from the social group feel in affective situations. Finally, the behavioural component is linked with specific behaviours we do or we want to do with people from the social group and the expectancies we have about how people from the social group can behave. In empiric studies, the Triandis model best predicts of different outcomes (Valois et al., 1988).

1.3. Traditional games. A tool for transforming stereotypes in educational contexts

The approach to education promoted by the UN CRPD Convention (2007)is based on a growing body of evidence that shows that inclusive education not only. Provides the best educational environment, including for children with intellectual disabilities, but also helps to break down barriers and challenge stereotypes. This approach helps to create a society that readily accepts and embraces disability, instead of fearing it. When children with and without disabilities grow up together and learn, side by side, in the same school, they develop a greater understanding and respect for each other (UN, 2007, p.3).

This study is grounded in the theoretical principle that participation in appropriate Traditional Sports Games (TSGs) programmes can alter participants' attitudes associated with negative stereotypes, which often encompass prejudices and erroneous beliefs about individuals with disabilities and the female gender.

Multiple empirical pieces of evidence demonstrate that attitudes are acquired and can be modified through intervention programmes (Triandis, 1971; Rosenbaum et al., 1986b; Eagly and Mladinic, 1989; McDougall et al., 2004; Bohner and Dickel, 2011; Cameron et al., 2011; McKay et al., 2015; Mirnezami et al., 2015; de Ocariz Granja and Lavega Burgues, 2015). Amongst the theories that explain the promotion of attitude transformation, this project draws upon contact theory (Allport, 1954; Pettigrew, 1998). According to Allport's Intergroup Contact Hypothesis (Allport, 1954), the main way to change attitudes is to put in touch people from diverse groups. It is believed that contact with diverse individuals tends to induce attitude changes when presented within a context of institutional support that encompasses three conditions (McKay, 2018; McKay et al., 2021): (a) Equality of status (wherein the game rules are the same for all participants); (b) Pursuit of common goals (wherein the inherent logic of the game poses similar problems to be solved); (c) Meaningful personal interactions (wherein individuals who engage in the game tend to bring their complete organic, affective, relational, and cognitive experiences, Pic et al., 2019).

In addition to those above, attitudes stem from both a personal evaluative construct and a normative construct that emerge from behaviours occurring within social interaction contexts (Triandis, 1971; Schmidt and Rakoczy, 2019). Based on these scientific arguments, it seems reasonable to utilize TSGs to promote inclusive attitudes within an educational intervention programme. if adequately implemented, TSGs, as conduits for interpersonal relationship experiences founded on the democratic acceptance of rules and physical interaction between participants (often involving intense motor interaction with physical contact), can serve as excellent educational resources to transform potential attitudes that do not foster gender equality and social inclusion within the framework of intercultural physical education.

In the educational context, we start from the assumption that students' attitudes—for example, their behavioural intentions—are influencing social participation (Crano and Gardikiotis, 2015; Marín-Suelves and Ramón-Llin, 2021). The practise of Traditional Games and Sports (TSG) in formal contexts could favour the transformation of participants' attitudes regarding issues of core goals as social inclusion of disabled people.

1.4. Measuring attitudes towards people with disabilities

Attitudes are difficult to measure directly, so self-report scales are used as measures for the study of prejudice (Armstrong et al., 2017). From the 70s studies began to appear on the attitudes of subjects towards those with disabilities and began to raise awareness about the importance of producing changes in attitudes in the population (Santiago García et al., 2003). These are essential to be able to change people's attitudes towards people with disabilities or mental disorders. Some of the scales highlighted in the literature that have been used by various authors, such as the *Reported and Intended Behaviour Scales* (RIBS; Evans-Lacko et al., 2011; Evans-Lacko et al., 2013), were not based on the Triandis model. Then, Rosenbaum et al. (1986a,b) created the Chedoke–McMaster Attitudes towards Children with Handicaps (CATCH) scale to fill this gap. However, they did not find a three factor structure, as it was predicted by the Triandis (1971) model. Later studies have found diverse results (De Boer et al., 2012; Bossaert and Petry, 2013; Armstrong et al., 2017). In fact, these more recent studies have tried to reduce the number of items used (the initial measure consisted of 36 statements). Hence, though it has been used, the standard CATCH measure has received mixed results regarding its validity and its reliability. Even though, there is a consensus regarding the usefulness of the CATCH to assess attitudes, as it has been used in research up to 16 years, being recommended as a reliable, valid and complete measure (Vignes et al., 2008). In fact it is one of the few scales that evaluate the effectiveness of programmes designed to promote positive attitudes towards their people with disabilities (Tavares, 2011). Thus, the CATCH seem to be one of the most complete instruments amongst those identified in the review made by Vignes et al. (2008) as they include all three attitude components and have appropriate psychometric properties.

1.5. Opportunity project. Networking for transforming stereotypes

Opportunity is a co-funded project by the Erasmus Programme of the European Commission (EACEA). Nine partners from 7 countries (Spain, France, Portugal, Italy, Croatia, Poland and Tunisia) as well as several associated partners from Russia and other continents have been sharing the efforts from January 2021. The project aims to promote of Traditional Games and Sports (TSG) as a tool for fostering social inclusion of people with intellectual disabilities within a variety of educational scenarios.

Opportunity project offers an opportunity for networking of organisations and professionals from different countries and continents interested in transforming stereotypes about people with disabilities through TSGs. This project provides a free APP with the CATCH-TSG questionnaire translated and adapted to other languages.

As far as we now, no previous attitudes towards disabled people's test have been adapted to physical activities. Hence, the objective of the present study was to adapt some items of the CATCH scale to generate the CATCH-TSG (CATCH applied to Physical Activity by using Traditional Sporting Games) to fit the physical activity topic, proposing versions in 8 languages. In addition, we prepared two versions of the instrument, one more suitable to adults and another one better for adolescents. Then, we tested the validity and reliability of in all the languages. We hypothesised that the CATCH-TSG would be a valid and reliable measure to assess attitudes.

2. Methods

2.1. Sample

A total of 3,706 participants completed the CATCH-TSG. Participants were selected through a non-probabilistic process (incidental, snowball, and convenience). They answered first some sociodemographic items, membership of sports clubs, and aspects related to language, in order to detect responses made in an incorrect version of test.

The assessment was performed between March and September 2020. Adolescents and adults were measured in each of the 6 countries where the research was executed (in Tunisia we recruited 2 different samples, Arab and French). Table 1 shows basic demographic data. We had more responses in the adult version, with an overall percentage of women of 56% (male 43.4% and non-binary 0.6%).

2.2. Instrument

The CATCH scale was created by Rosenbaum et al. (1986b) as a self-administered scale for children ages 9 to 13 to measure attitudes toward their peers with disabilities. The CATCH consists of 36 items, 12 written negatively and the other half written positively, arranged in random order alternating positive and negative statements. Before administering the questionnaire, participants are told to interpret the word "disabled" as they understand it without presenting any specific stimulus for clarification. The rationale for this approach is that regardless of disability, children tend to have similar attitudes toward children with disabilities (Rosenbaum et al., 1986a). Finally, the answers are recorded using a 5-Likert scale (from strongly disagree to strongly agree; Armstrong et al., 2016).

2.3. Data retrieval

To collect the necessary information for this study, a survey website[1] was developed. The website consisted of three main components: the front-end, developed using Angular[2]; the back-end, developed using NodeJS[3] to handle communications and calculations; and the encrypted MongoDB[4] database, which stored the data to ensure user privacy.

Accessibility was prioritised to accommodate a diverse range of users. To achieve this, a mobile-first design approach was adopted, and the application was translated into multiple languages. The use of neutral colours further enhanced usability for visually impaired individuals.

Additionally, an admin panel was implemented to enable supervisors to oversee and ensure the smooth functioning of the

1 http://opportunityproject.eu/
2 https://angular.io/
3 https://nodejs.org/en
4 https://www.mongodb.com/

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TABLE 1 Demographic data.

Version	*n*	Mean age	SD age	Age maxim	Age minimum	%Female sex
Arab Adult	156	27.2	11.2	72.0	18.0	26.3%
Arab Youth	154	14.2	2.0	18.0	11.0	40.3%
French Adult	174	36.4	16.8	72.0	18.0	52.9%
French Youth	203	14.5	1.9	18.0	11.0	35.0%
Italian Adult	391	24.8	12.2	72.0	18.0	82.6%
Italian Youth	176	15.6	1.4	18.0	11.0	80.1%
Polish Adult	268	32.7	12.0	65.0	18.0	59.0%
Polish Youth	209	13.7	2.1	17.0	11.0	58.9%
Portuguese Adult	375	28.2	13.6	64.0	18.0	38.9%
Portuguese Youth	258	14.1	2.0	18.0	11.0	52.7%
Russian Adult	287	21.6	6.6	60.0	18.0	73.3%
Russian Young	163	16.2	1.0	18.0	14.0	60.1%
Spanish Adult	342	28.5	12.6	76.0	18.0	50.1%
Spanish Young	550	13.7	1.6	18.0	11.0	54.5%

activity. The supervisors played a crucial role in providing feedback on the system, enabling iterative improvements over time.

Given the intermittent nature of survey demands, it was imperative for the system to support high loads efficiently. To address this, a container-based cloud hosting solution (Ruíz et al., 2022) was selected. This approach facilitated rapid scaling based on demand and subsequent resource downsizing, making the system both resource-friendly and environmentally sustainable.

To cater to a global user base, the system was translated into 10 languages and implemented real-time translation without incurring any downtime. Docker[5] was chosen for building and deploying the system, offering seamless deployment capabilities.

Overall, the survey website's design and infrastructure were carefully developed to ensure data collection, accessibility, supervisory oversight, scalability, and global availability.

2.4. Procedure

The CATCH adapted to a context of physical activity (CATCH-TSG) was created to assess the attitudes of children and adults towards disability in this setting. We generated the items to ask about physical activity situations using a language adapted to both versions (Youth and Adult). We produced the first adapted versions in English. Then, both forms were translated into the 7 study languages: Arab, French, Italian, Polish, Portuguese, Russian and Spanish. Native members of the research team conducted translations and back-translations.

The adaptation process necessitated modifications in approximately half of the items in the original version, precisely 36 items, with a specific focus on 8 out of the 19 items featured in the final iteration. These alterations were meticulously crafted to imbue each element with a contextual essence firmly grounded in the domain of Traditional Sports Games. Moreover, gender-specific references, thoughtfully calibrated to resonate with adult and young audiences, were deployed, incorporating each respective language's most contemporary linguistic nuances. Our commitment to employing the most precise and inclusive language extended to our discussions surrounding disability across all languages involved in this endeavour.

Within the framework of the Opportunity study, each partner assumed the role of an autonomous panel responsible for their designated language, thereby affirming the validation of the translation and adaptation process through consensus. In each language, a team of two translators was engaged in the translation process from English to the respective local language. Subsequently, both translations were juxtaposed, and in the event of disparities, the two translators collaborated to forge a consensus-based rendition. This reconciled version was then entrusted to another pair of translators for the reverse translation into English, whereupon it was scrutinised against the original version. In cases where discrepancies persisted, all four translators collectively contributed to the ultimate formulation of the local version. Notably, Tunisian partner assumed responsibility for the adaptation efforts pertaining to both the French and Arabic languages, resulting in the exclusive utilization of these languages within the borders of Tunisia.

The meticulous design of the questionnaire administration procedure was underpinned by a commitment to flexibility and inclusivity across all participating countries. Within the expansive ambit of the Opportunity Project, the questionnaire was adeptly administered through a dedicated application (APP), guaranteeing accessibility and user-friendliness for all respondents. Regardless of their geographic location, individuals utilizing the application to partake in the questionnaire exercise were afforded the liberty to select the language that resonated most harmoniously with their sensibilities.

This innovative approach afforded respondents a spectrum of languages to choose from, thereby ensuring that the questionnaire was attuned to their linguistic predilections. Consequently, participants from Tunisia and other nations were empowered with the agency to

5 https://www.docker.com/

complete the questionnaire in their language of choice, a pivotal stride towards fostering inclusivity and accommodating the rich tapestry of linguistic diversity woven by participants.

2.5. Statistical analyses

The statistical analysis corresponds to a psychometric study focused on reliability and construct validity combining Exploratory a Confirmatory Factor Analysis. The validation process involved several phases, including creating a version of CATCH adapted to a particular scenario, with 7 different languages and two distinct versions (youth, and adults). This combined procedure was explained below.

We first applied Exploratory Factor Analysis (EFA) with Principal Components Analysis, Maximum Likelihood extraction method, based on parallel analysis with Oblimin Rotations, in the more suitable sample. As the CATCH questionnaire (Rosenbaum et al., 1986a) was created for children and adolescent populations, we began the validation of CATCH-TSG with the youth version and with the larger sample, precisely the Spanish youth sample.

Once we established the factorial solution in the initial sample, we carried out Confirmatory Factor Analyses (CFA) to test whether the initial solution was replicated in the other 6 samples. We made different attempts to maximize the Fit indexes and reliability coefficients.

The model, which was derived through EFA, underwent a re-specification process aimed at refining its structure. In this endeavour, we incorporated an additional item into Factor 1, and augmented Factor 3 with the inclusion of two more items, with the overarching objective of attaining a commendable reliability coefficient of 0.6. Furthermore, we introduced residual covariances, extending up to four instances, in order to bolster the goodness-of-fit indices of the models subjected to CFA.

After youth version validation, we applied the same methodology (CFA) in all 7 adult samples.

When we finished the validation of 36-items versions, we initiated the validation of a reduced version for facilitating the usage of the CATCH-TSG in difficult contexts. So, first, we used EFA and CFA in the sample of Spanish adolescents. The goal was to obtain a 4-factor short version with 4 items per factor, with a reliability coefficient restriction that consisted in add items in the worst factors if needed.

Finally, we used CFA in all the other samples to replicate the shortened solution.

3. Results

3.1. Young population full model

With the initial EFA of 36 items we obtained a solution with 4 factors which explain the 41.85% total variance [Chi-square Bartlett's (630) = 6345.88; $p < 0.001$. and KMO MSA Overall = 0.92]. Interpreting what the items shared in common in each factor we named the first one as "positive interpersonal attitudes" and the second one as "negative interpersonal attitudes," both towards disabled people. Factor three was related to the cognitions that respondents had regarding disabled people, and because of this commonality we named this factor "social cognition." Finally, the last factor was manly focused on the help that responders believe that disabled people need, so the fourth factor was named "behavioural help." Table 2 presents the CFA goodness-of-fit statistics in the 7 languages. We also show the reliability coefficients of each factor in each language. As can be seen, the worst reliability in most samples corresponds to factor 3, and the best reliability corresponds to factor 1. The adjustments, based on the different criteria, range from a very good fit in Spanish to the worst results, obtained in Arab.

3.2. Adult population full model

After the initial validation of the adolescent version, several CFAs were carried out in the 7 languages in adult samples. Table 3 shows the CFA goodness-of-fit statistics in all the 7 adult samples and also the reliability coefficients.

As can be seen, the pattern of results obtained is similar to the obtained results in Youth, the worst results refer to factor 3 and in the Arabic version, while the best results are obtained in the Spanish version.

3.3. Young population reduced model

We first established the constrain to maintain the initial 4 factor solution in the short version, and to use in a combined form, a reliability threshold criterium to generate this reduced version. The short version could not reduce Cronbach's alpha values below 0.6 in any factor if in the full version, Cronbach alpha was higher than 0.6. Following these criteria, we obtained a 19 items solution with PCA in the young Spanish sample. This solution, explained the 49.67% of the variance [Chi-square Bartlett's test (171) = 2473.86; $p < 0.001$. and KMO MSA Overall = 0.84]. Table 4 shows all the goodness-of-fit statistics and reliability in all the samples. As can be seen, the best reliability corresponds to factor 1 and the worst reliability, to factors 3 and 4 is almost 0.6. The adjustments, based on the different criteria, range from a very good adjustment in Portuguese and the worst results obtained in Arab.

3.4. Adult population reduced model

Finally, as in the complete version, a CFA was carried out in the 7 samples to test the shortened version of the scale in the adult samples (See Table 5). The best reliability still corresponds to factor 1 and the worst reliability to factor 4. The adjustments, based on the different criteria, range from a very good adjustment in Portuguese and the worst results are again obtained in Arab.

4. Discussion

The objective of the present study was to adapt some items of the CATCH scale to generate the CATCH-TSG (CATCH applied to Traditional Games) to fit the physical activity field. The CATCH scale (Rosenbaum et al., 1986a) has enabled and now enables researchers to measure children's attitudes towards disability. The present study provides evidence of the validity of the CATCH-TSG scale, a CATCH

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TABLE 2 Results obtained from the CFA of the 6 versions analyzed, in the complete questionnaire of 36 items for the youth version.

Language	χ^2	D.f.	p	CFI	TLI	RMSEA	AIC	α-1	α-2	α-3	α-4
Spanish								0.89	0.73	0.54	0.67
Arab	643.88	310	<.001	0.732	0.697	0.084	11821.6	0.78	0.63	0.32	0.47
French[1]	584.25	304	<.001	0.848	0.824	0.067	15848.3	0.79	0.67	0.57	0.52
Italian	592.51	360	<.001	0.876	0.860	0.061	11238.4	0.87	0.82	0.51	0.47
Polish	557.90	310	<.001	0.881	0.865	0.062	13077.4	0.90	0.74	0.59	0.65
Portuguese	510.80	316	<.001	0.921	0.913	0.049	16143.9	0.91	0.81	0.64	0.67
Russian	505.49	313	<.001	0.762	0.733	0.061	12799.2	0.73	0.77	0.34	0.32

D.f. = Degrees of freedom; α-1: Cronbach's alpha of factor 1; α-2: Cronbach's alpha of factor 2; α-3: Cronbach's alpha of factor 3; α-4: Cronbach's alpha of factor 4. [1]Tunisia.

TABLE 3 Results obtained in the Spanish sample and in the 7 versions of the CFA in the complete questionnaire of 36 items for the adult population.

Language	χ^2	D.f.	*p*	CFI	TLI	RMSEA	AIC	α-1	α-2	α-3	α-4
Spanish	579.55	310	<.001	0.891	0.876	0.050	19762.2	0.85	0.75	0.57	0.57
Arab	638.36	315	<.001	0.731	0.700	0.081	10628.2	0.82	0.72	0.51	0.59
French[1]	576.91	314	<.001	0.762	0.734	0.069	11934.5	0.78	0.74	0.33	0.59
Italian	589.62	314	<.001	0.912	0.901	0.047	21083.9	0.88	0.76	0.53	0.50
Polish	511.81	309	<.001	0.901	0.887	0.049	15970.7	0.87	0.75	0.54	0.56
Portuguese	589.72	312	<.001	0.914	0.903	0.049	22009.2	0.88	0.80	0.49	0.65
Russian	654.95	310	<.001	0.852	0.833	0.062	17999.2	0.84	0.77	0.61	0.52

D.f. = Degrees of freedom; α-1: Cronbach's alpha of factor 1; α-2: Cronbach's alpha of factor 2; α-3: Cronbach's alpha of factor 3; α-4: Cronbach's alpha of factor 4. [1]Tunisia.

adaptation to a physical activity environment for young and adult people in Arab, English, French, Italian, Polish, Portuguese, Russian and Spanish. Also, we created a short version facing both age groups, and all the languages. And the versions do not have the best-fit indices nor reliability coefficients, in each particular language and age version. But our adapted and reduced scale combines the best fit indices and reliability coefficients, using the same items and configuration of factors.

The three-factor solution initially provided by Rosenbaum et al. (1986a,b) for the CATCH was not replicated in the CATCH-TSG. This is not new, as many past studies found different solutions validating the original CATCH (Bossaert and Petry, 2013). On the other hand, it has also been proposed to introduce different channels, such as a video or a vignette of a peer with disabilities, to encourage change in attitudes (Beattie et al., 1997; Bossaert et al., 2011; Link et al., 2004; Manetti et al., 2001). However, we approximated the theoretical model proposed by Triandis (1971) because factors 1 and 2 can be interpreted as attitudes with more emotional contents, while the third one is a more cognitive factor. Finally, the behavioural component can be seen at factor 4. So, though without a perfect fit with the original solution, we agree with past studies (Armstrong et al., 2016; Vignes et al., 2008), which suggest that the CATCH scale is a complete instrument to assess the cognitive, affective and behavioural component of individuals towards disability, with good enough psychometric properties.

The present study is relevant because we adapted the CATCH into a physical activity context, and we tested whether a shortened version was possible. In fact, we found that the 19 items of the CATCH-TSG version were at least as valid as the full version. In general, reliabilities were good enough, though some languages, especially Arabian and Russian, demonstrated low reliabilities. However, according to Ziegler et al. (2014) short scales are good when we need to include them in comprehensive studies, and they have not demonstrated to be worse than the complete versions.

4.1. Limitations

It is necessary to consider several limitations when interpreting the results of this work. First, although the study was represented by a diverse set of countries and populations, the sample was within 200 subjects in some countries, thus restricting the variety of stigma responses. The sample had to be reduced because some answers' quality was not the same since invented or false response patterns were observed. In addition, the effects of sample collection were affected in some countries due to the COVID-19 situation adding variability in samples.

Second, cultural differences mark different styles of attitude towards disability stigma. The geographical distribution of individuals also influences the information and quality of mental health services and the awareness and dissemination of stigma amongst individuals in society. On the other hand, in the case of the Arabic language, which obtained the worst reliability scores in the factors of the CATCH-TSG, it must be taken into account that it is a language with many localisms. The version of the test, in which a standard language was used may have interfered with the interpretation and understanding of the items.

Thirdly, the writing of the items can stimulate acquiescence (the tendency of responding to agree with the questions of the test without prior reasoning). However, this is an intrinsic problem with the original measure (Rosenbaum et al., 1986a). One method used to minimise this effect is the reverse coding items written negatively, so that high scores represent a more positive attitude.

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TABLE 4 Results obtained in the Spanish sample and in the other six versions of the CFA in the shortened version of 19 items for the youth version.

Language	χ^2	D.f.	p	CFI	TLI	RMSEA	AIC	α-1	α-2	α-3	α-4
Spanish								0.80	0.67	0.64	0.67
Arab	304.64	144	<.001	0.770	0.727	0.085	8295.5	0.64	0.39	0.55	0.47
French[1]	207.13	139	<.001	0.931	0.915	0.049	11431.7	0.63	0.61	0.73	0.52
Italian	208.33	140	<.001	0.928	0.912	0.053	7432.3	0.80	0.74	0.67	0.47
Polish	260.24	141	<.001	0.903	0.882	0.064	9190.4	0.80	0.73	0.72	0.65
Portuguese	228.67	145	<.001	0.933	0.921	0.047	11706.2	0.82	0.75	0.60	0.67
Russian	259.53	146	<.001	0.725	0.678	0.069	9110.1	0.47	0.67	0.44	0.32

D.f. = Degrees of freedom; α-1: Cronbach's alpha of factor 1; α-2: Cronbach's alpha of factor 2; α-3: Cronbach's alpha of factor 3; α-4: Cronbach's alpha of factor 4. [1]Tunisia.

TABLE 5 Results obtained in the Spanish sample and in the 7 versions of the CFA in the shortened version of 19 items for the adult population.

Language	χ^2	D.f.	p	CFI	TLI	RMSEA	AIC	α-1	α-2	α-3	α-4
Spanish	260.37	136	<.001	0.918	0.897	0.052	14070.1	0.78	0.71	0.66	0.57
Arab	209.20	138	<.001	0.873	0.843	0.058	7563.7	0.67	0.60	0.60	0.59
French[1]	236.48	143	<.001	0.861	0.833	0.061	8482.53	0.67	0.67	0.54	0.59
Italian	273.82	144	<.001	0.925	0.911	0.048	15384.3	0.82	0.71	0.63	0.50
Polish	222.73	144	<.001	0.927	0.914	0.045	11531.9	0.77	0.70	0.65	0.56
Portuguese	272.313	142	<.001	0.929	0.915	0.049	15632.4	0.81	0.76	0.59	0.65
Russian	268.05	134	<.001	0.895	0.866	0.059	12832.4	0.73	0.68	0.71	0.52

D.f. = Degrees of freedom; α-1: Cronbach's alpha of factor 1; α-2: Cronbach's alpha of factor 2; α-3: Cronbach's alpha of factor 3; α-4: Cronbach's alpha of factor 4. [1]Tunisia.

4.2. Conclusion

We should increase the sample size and revise some translations in future studies. For this purpose, the survey collection system employed in this study exhibits robustness, leverages state-of-the-art technologies, and effectively fulfils the investigation's requirements. Therefore, it is well-suited for utilization in future iterations of similar research endeavours. In addition, using a longitudinal design with repeated measures to develop future evidence-based clinical strategies is advisable. However, the present study must be taken as the first approximation to the validity and reliability of the CATCH test adapted to physical activity contexts. Considering this fact, we believe that the CATCH-TSG is valid and reliable enough to continue researching it.

Data availability statement

The datasets presented in this article are not readily available because we do not yet have the authorisation of all the countries involved. Requests to access the datasets should be directed to JR-T, josep.riustorrento@udl.cat.

Ethics statement

The studies involving humans were approved by the Ethics Committee for clinical research of the Catalan Sports Council; number 09/CEICGC/2020. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1254580/full#supplementary-material

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After-school sports programmes and social inclusion processes in culturally diverse contexts: Results of an international multicase study

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This research aimed to understand the role of after-school sports programs in social inclusion processes in culturally diverse contexts through a multicase study within two locations. The first location was in Spain where immigrant and Spanish students were enrolled, and the other was in Chile with Mapuche-Huilliche students, immigrant and Chilean students. The implemented programs at both sites were similar in their educational focus on socio-educational values, and teaching models (hybridization of teaching games for understanding and cooperative learning) that enhance social inclusion. Using individual and group interviews with teachers, sports coordinators, parents, and students, a qualitative approach was used to identify the factors that facilitate or hinder the social inclusion processes. In addition, the researchers used qualitative observations of the programs over six months using "notes logbook" to record their impressions during the observation process. Results indicated that the implemented sports programs successfully facilitated social inclusion processes, enabling the development of interpersonal skills and relationships between students from different cultural backgrounds. The previous training and experiences of teachers in culturally diverse contexts, and incorporation of traditional sporting games from all cultures, seems to be an important facilitator factor for the inclusion potential of the implemented programs.

KEYWORDS

social inclusion, immigrant students, Mapuche, after-school programmes, sports programmes, ethnic groups

1. Introduction

The current reality of a globalized world generates the intensification of cultural diversity in society (Civitillo et al., 2017), transforming school contexts through the social fabric change and new relationships building in the classrooms (Fruja, 2019). This increase in a more culturally diverse classroom environment has positioned the country's educational school settings as transcendental spaces for the early promotion of intercultural skills (Zhang and Zhou, 2019), by being challenged to recognize different cultural identities and ethnic groups under a framework of social equity (Graham, 2016). School-based sports programs are recognized as influencing and shaping students' acquisition of values, self-management and interpersonal skills, along with movement skill competencies that contribute to their cognitive, emotional, social and motor development and facilitate inclusion in society, whilst also preparing them for the future (Bessa et al., 2019).

In schools across Europe, Latin America, and Australia, cultural diversity is reflected through multiple expressions and identities (Wiium and Dimitrova, 2019). For example, in Spain and Chile, immigration has been a factor in recent years that has contributed significantly to the increase in the cultural diversity of schools (Berríos-Riquelme et al., 2021; Martínez-Rojas et al., 2021). In Chile, members of indigenous peoples (e.g., Mapuche as a macroethnic group composed of four collectives: Mapuche-Picunche, Mapuche-Huilliche, Mapuche-Pehuenche, and Mapuche-Lafquenche) also have a high presence in the school system, representing specific cultures, worldviews, and ancestral knowledge (MDSF, 2018; De la Maza and Bolomey, 2019).

Currently in Spain, the percentage of the foreign population is up to 11.5% (INE, 2022), while in Chile, it recently is at its highest historical percentage of 7.5% (INE, 2021). These percentages of the foreign population are reflected in schools in both countries (Estalayo et al., 2021; Carter-Thuillier et al., 2022). In Spain, 11.6% of the students come from countries other than Spain (Fundación Europea Sociedad y Educación, 2020), while in Chile, the enrollment of immigrant students has quadrupled during the period 2014–2018, currently reaching 5.3% (SJM, 2022). Likewise, in the latter country, members of indigenous peoples have historically represented a high percentage of the population. In fact, according to the latest official statistics, the Mapuche people (composed of the previously named four collectives) are the main ethnic group which represents 9.9% of the national population (CASEN, 2017) and 2.5% of all school students of the country (MDSF, 2016). In short, cultural diversity is a relevant challenge for schools in Spain and Chile.

In each context, unique relationships are shaped between members of the migrant population, different ethnic groups and the rest of society (Banks, 2016). However, different studies have shown that in both countries, immigrant students are constantly at risk of segregation and social exclusion, especially when they are from a low socio-economic family background and had a precarious schooling situation in their original countries (Goenechea, 2016; Lara, 2017; Caqueo-Urízar et al., 2021; Martínez-Rojas et al., 2021; Martinez, 2022). Likewise, recent research indicates that in Chile and Spain, schools have usually been the setting where local cultures are taught, and often imposed upon immigrant students leading to them relinquishing their own culture and assimilating into the culture of the receiving country (García-Yepes, 2017; Pincheira, 2021). This has sometimes led to resistance and rejection by immigrant students in both contexts (Lara, 2017; Carrillo-Sánchez, 2021). The situation of Chilean indigenous peoples is historically similar, as the school has systematically imposed the hegemonic culture through a monocultural curriculum that does not provide space for the customs, beliefs and ancestral knowledge of the ethnic groups (Breidlid and Botha, 2015; Turra et al., 2017). Specifically, Mapuche ethnic groups for decades have suffered a significant weakening of cultural identity through school education, consistently forcing them to deny their linguistic, bodily and educative practices (Carter-Thuillier et al., 2018; Caqueo-Urízar et al., 2021). These assimilation processes are favored by discourses that define cultural diversity as having a negative impact on educational and social aims (Hellgren and Gabrielli, 2021; Salas et al., 2021; Webb, 2021; Vollrath, 2022), and legitimize isolation and exclusion strategies toward students belonging to immigrant or indigenous groups (Plenty and Jonsson, 2017). However, according to Berry (2005) imposed assimilation from the dominant culture usually generates reactive behaviors in minority groups, which is the case of the Mapuche-Huilliches, who, for decades, have systematically opposed the policies of the Chilean State (Zuñiga and Olate, 2017).

Finally, the above-described situation has generated the need to design and implement educational strategies based on dialogue and respect among different ethnic groups in order to facilitate social inclusion (Carter-Thuillier et al., 2022) *via* positive experiences within culturally diverse contexts (Juvonen et al., 2018; Smith et al., 2019; Lleixà and Nieva, 2020). In this regard, sport has shown a clear potential for social inclusion in migration and ethnic contexts (Künis et al., 2016; Burrmann et al., 2017; Smith et al., 2019; Middleton et al., 2020), since it is a supra-cultural (Paredes and Reina, 2006) and transcultural (Heinemann, 2022) space that can serve as a meeting point for positive interaction (Ekholm, 2018; Middleton et al., 2020; Mohammadi, 2022). In fact, various scholars (Skille and Fahlén, 2020; Papageorgiou et al., 2021; Pedersen et al., 2021) have argued that sports activities can be a favorable space for the development positive social interactions between people from different cultures, especially when developed using an "intercultural" approach, which not only implies eliminating fear and prejudice toward "others," but also assuming interaction as an opportunity for learning and communication. Thus, the universal framework offered by motor praxeology as a possibility of human action can facilitate the development of social interactions in culturally diverse contexts (Bortolotti, 2021). Furthermore, the particular characteristics of sport make its application very viable and useful in cultural diversity school-contexts to promote social inclusion without losing cultural identities (Cockburn, 2017; Flensner et al., 2021). However, sports can also spark conflicts, foster racial stereotypes, and perpetuate unbridled rivalries among ethnic groups, cultures, and nationalities (Barker et al., 2013; Van Sterkenburg et al., 2019; Kavanagh, 2022). Therefore, it needs to be carefully planned, examined, and implemented to become a true alternative to these collateral risks (Grimminger-Seidensticker and Möhwald, 2017). Especially, the educators' intercultural competence or sensitivity toward cultural diversity might play a crucial role in implementing intercultural education programs in sports (Grimminger, 2012).

As such, in this article we will refer to the term "school sports" (SCSP) as all sport activities that are practiced at school for educational purposes, out of physical education class but usually in after-school programs, focusing on the development of personal and social values as well as on physical performance, in coherence with the school curriculum (Blázquez, 2010). Among such values, issues of cultural identity, cultural diversity, and social inclusion are listed to enhance reciprocal knowledge of the customs, practices and world views of all students in combination with the promotion of motor skills (Jiménez-Herranz et al., 2016; Carter-Thuillier et al., 2018; Fernández-Gavira et al., 2018). However, there is rarely research about the effect of such SCSP programs on the aspired pedagogical aims. The few systematic reviews (Fernández et al., 2013; Carter-Thuillier et al., 2017; Heath et al., 2018; Shields and Lujan, 2018) of the last decade have shown that there are few reports on the effects of SCSP programs in contexts of immigration and ethnic groups, or whether these initiatives developed in school settings manage to use the potential of sport to really favor the preservation of identities and the building of positive intercultural relations.

Specifically, the work of Fernández et al. (2013) shows that most of the research on foreign population and sport concentrates on "migration of sport talents" and "sociological studies," with school being a context where practically no research is carried out in this regard. In the case of Carter-Thuillier et al. (2017), it is noted that over the last 5 years the volume of research on the use of sport in schools to promote social inclusion processes where there are people of different nationalities and cultures has slowly grown. Shields and Lujan (2018) review exhibit how participation in sporting activities contributes to social inclusion in contexts with a migrant population, while Heath et al. (2018) show how participation in extracurricular activities (e.g., SCSP) fosters the socialization of young migrant populations.

2. Purpose of the study

To explore the role of SCSP programs on social inclusion processes in culturally diverse contexts, in Spain and Chile. The first context for the SCSP program in Spain involved immigrant and Spanish enrolled students. The second context is a SCSP program in Chile with Mapuche-Huilliche students (Chilean nationality), immigrant students and Chilean students (non-members of indigenous groups).

3. Materials and methods

A qualitative multi-case study was conducted. In particular an ethnography of two case studies was carried out with two specific groups, each composed of individuals with similar and shared traits, habits, and contexts. This double source of data was useful to understand the commonalities and differences of both cases (Stake, 1995). As such, qualitative techniques and instruments were used to identify and analyze traits stemming from participants' perceptions, ideas, and motivations regarding the process of social inclusion through SCSP.

3.1. Contexts and participants

The first case study aimed to analyze the social inclusion processes in a SCSP program in Spain and focused on the interactions [according to American Psychological Association [APA]., 2022), any process that involves reciprocal stimulation or response between two or more individuals] between migrant students from different nationalities and their relationships with other actors in the context: classmates of different nationalities, teachers, program coordinators, family members, among others. In this study, only those students with a nationality other than Spanish have been considered immigrant students.

The Spanish case study was part of a larger research project developed jointly by a City Council and a University. It aimed at developing a SCSP program with social transformation purposes to intervene upon and modify certain negative dynamics that had emerged in previous sporting contexts during the school stage between native and migrant students, while focusing on promoting social and civic values. Given its formative and inclusive approach, not use a competitive logic and early sport specialization, this SCSP program had features that make its analysis useful and valuable, e.g., promotion of values such as cooperation, solidarity, mutual respect, etc.). This SCSP program was implemented during the school year in 24 school centers. It took place after school, every week, Monday and Thursday, with 2-h training sessions. On Fridays, sporting meetings were held for students from all schools. On that day, broader meets were carried out, with a high number of students, since the teams were composed of students from different educational centers. For that purpose, sports activities of short duration were organized related to the sport being studied in the general school programming. No official results or standings were registered.

All class sessions were designed based on a hybrid model that mixed "Teaching Games for Understanding" (TGfU) and a cooperative learning approach. The TGfU was implemented considering the principles proposed by Tan et al. (2012): (a) sampling; (b) tactical complexity; (c) representation; and (d) exaggeration. The cooperative learning approach followed the recommendations of Dysob and Casey (2016): (a) positive interdependence; (b) interpersonal and small groups skills; (c) face-to-face interaction; (d) individual accountability; and (e) group processing. Both models have pedagogical characteristics and structural principles that allow their complementary use (Fernandez-Rio, 2014), this means: (a) a student-centered process; (b) learning in participative contexts; (c) positive interdependence; (d) enhanced responsibility among students; (e) authentic learning activities; (f) focusing on social, physical, and cognitive development processes; and (g) active learning through decision-making, social interaction, and cognitive comprehension. Pedagogical principles outlined above (hybrid model of TGfU and Cooperative Learning) were displayed with the following sports activities: (a) basketball; (b) handball; (c) futsal; (d) track and field; (e) volleyball; and (f) rugby. Additionally, it worked all year: (a) activities to learn to run at aerobic rhythms; (b) social values and living habits; (c) basic aspects to practice physical activity (warm-up, heart rate control, hydration, etc.); and (d) traditional sporting games (TSG) related to the cultures present in the classroom. Some examples of TSG observed in the sessions: "Chirra" a TSG

from North Africa similar to hockey, the "seven stones" a typical collective TSG of Central America and the Caribbean where a "tower" of balls is built and teams try to knock it down by throwing small balls from a distance of approximately 7 m, "Blind Hen" TSG from of South American countries where a child blindfolds and tries to catch the rest of his classmates, among others. For more details on these games, see Bantulá and Mora (2005).

The observed participants were 114 students (56 immigrants: 34 boys and 22 girls),with range age 7–12 years (M = 9.43; SD = 1.56). They belonged to 11 different groups of SCSP, operating in six schools (the schools with the highest percentage of immigrant students were selected). All migrant students were first generation in the country and all of them were born abroad, and came mostly from North Africa, Eastern Europe, East Asia, South America, Central America, and the Caribbean. Spanish students (35 boys and 23 girls) were of the same ages as their migrant counterparts. All this information was provided by the program coordination.

The study also involved eight teachers, who implemented the SCSP program. Some of them were pre-service teachers in the last year of their university education. their ages ranged between 21 and 30 years (M = 23.87; SD = 2.71). To work in the SCSP program, teachers had to pass a specific training course, focusing on: methodology, session structure, organization and control of the group, warm-up, conventional sports and alternative sports, physical-sports activity and healthy habits, education in values, and conflict resolution. They also learned basic principles of intercultural education and TSG, subjects were taught by the program coordination and professionals from the university. Specifically, with regard to interculturality, teachers received training on values associated with respect and attention to cultural diversity, the positive recognition of cultures and strategies to promote interaction between people from different cultures. In regards to the training on TSG, traditional games from the countries present in the SCSP program were shared and explained since incorporating games from different cultures into the classroom is a favorable tool for recognizing and strengthening different cultural identities, and can also have a positive impact on the emotional state of students, their motor development, their ability to take decisions and the development of coexistence based on mutual respect (Pic et al., 2019; Martín-Martínez et al., 2021; Lavega-Burgués et al., 2023; Moya-Higueras et al., 2023). The program coordinator (male, 36 years old), who also participated in the study and had a specific training in physical education. His task was to supervise the teachers' work and to ensure that all SCSP groups function properly on an educational and organizational level.

The second case study aimed at analyzing the social inclusion processes in an SCSP program at a south macrozone city of Chile, focused on the interactions of Mapuche-Huilliche students, immigrant students and their relationships with others agents who participates in the context. The schools provided information on who are Mapuche and immigrant students. In this sense, students are recognized as Mapuche-Huilliche if they are enrolled in an indigenous community of the Chilean state and also recognize themselves as members of this people, in addition to having one (at least) last name that links them to this group. A total of 41.6% of them live in indigenous communities with other Mapuche-Huilliche people. In the case of immigrant students, they are those who have a nationality other than Chilean and are all foreign-born. The implementation of the SCSP program in Chile was legitimated by existing racist and discriminatory dynamics, particularly against Mapuche-Huilliches and migrants, as also reported in the introduction.

In this case study, 46 students (28 boys and 18 girls) were observed (24 of which were Mapuche-Huilliche students, 15 boys and 9 girls; 4 immigrants from Colombia and Venezuela, 2 boys and 2 girls), with ages ranging 7–12 years (M = 9.50; SD = 1.84). These participants belonged to two schools (four SCSP groups). This study also involved six parents or legal guardians of Mapuche-Huilliche and migrant students who were invited through the schools and agreed to participate voluntarily.

This program executed at Chile was created with analogous characteristics of the Spanish SCSP program, using in all groups the same education principles (focus on socio-educational values), teaching models (combining TGfU and cooperative learning) with the aim of enhancing social inclusion processes. The program followed also the same organizational structure: two school SCSP sessions were held each week, and on Fridays, formal sports meetings (all SCSP students groups came) took place in the centers. The pedagogical principles displayed in game situations are the same as in the first case study, including some playful-physical practices from the Mapuche culture (e.g., Mapuche ethnic TGS like Palin or Linao) (Poblete et al., 2020). Moreover, cooperative learning activities and situations were implemented into the program, to foster positive social relationships among all participants.

In addition to the students, two male teachers (21–30 years old; M = 25.5; SD = 4.5) and a male coordinator (30 years old) participated in the study; they all were specialists in Physical Education. Teachers' role was to implement the learning activities in each SCSP group; therefore, they received specific training on the same topics as their Spanish counterparts, the program coordinator and university professors were in charge of this training.

3.2. Data collection

The data collection techniques and instruments used in both case studies were: (a) participatory observation (6 months in each context), as, according to DeWalt and DeWalt (2011), it allows for systematic collection in naturalistic settings (e.g., communities of many different cultures) to understand the fundamental processes and patterns of these social spaces, (b) 18 in-depth individual interviews of key informants, and (c) 12 focus-group interviews with students. Sangaramoorthy and Kroeger (2020) state that individual in-depth interviews and focus groups can complement each other as data collection techniques, and can help to deepen the findings of systematic observations during ethnographic processes. In addition, the researchers used a "logbook," whereby they noted comments and preliminary conclusions of the research process (Whaley, 2014).

Following the suggestion by Taylor et al. (2015), observations non-structured was developed focusing on the interactions of the students (immigrants in Spain, Mapuche-Huilliche and immigrants in Chile) with the other actors. For the interviews, as recommended by Taylor and Bogdan (2000), no closed questions were defined, but a list of topics was used to guide the conversation focused

on social interactions of actors and social inclusion processes. Some examples: (i) interpersonal relations between immigrant, and Mapuche-Huilliche in Chilean case, students who participate in SCPS programs; (ii) interpersonal relations of immigrant students, and Mapuche-Huilliche in the case of Chile, with students who do not belong to cultural minorities; (iii) pedagogical practices that foster positive intercultural relations in the classroom; (iv) relationship between teacher and students from cultural minorities; (v) culturally motivated conflicts in the classroom; and (vi) conflicts occurring in the classroom due to cultural causes; among other issues. As for the individual in-depth interviews with key informants, in the two case study nine were undertaken (Spain: eight with teachers and one with coordinator; Chile: two with teachers; one with coordinator, and six with parents or legal guardians). Furthermore, while eight focus-group interviews were organized with immigrant students in the Spanish study (the students were subdivided into: eight groups of seven members), four group interviews took place in the Chilean context with students belonging to the Mapuche-Huilliche ethnic group and migrant students (here, the students were subdivided into: four groups of seven members).

3.3. Data analysis

Interviews and observations were full transcribed. The technique of "content analysis" (Taylor et al., 2015) was used to select, organize, and classify the data. This type of analysis allowed the researchers to formulate reproducible and valid inferences for each context studied. The process consisted of three phases: (a) discovery; (b) coding; and (c) relativizing of the data. **Table 1** shows the categories and subcategories that emerged from the analysis used for both case studies.

3.4. Ethics and trustworthiness

The studies involving human participants were reviewed and approved by the Academic Committee of the Doctoral Program in Transdisciplinary Research in Education at University of Valladolid (Spain) and the Bioethics and Biosafety Committee of the Universidad de Los Lagos (Chile). Written informed consent to participate in this study was provided by the participants and their legal guardians as appropriate in each case.

Specifically, In both case studies, four ethical criteria were considered: (a) informed consent of parents or legal guardians, teachers, and coordinators of each program; (b) informed assent of each student; (c) confidentiality of the identity of the participants; and (d) communication of the aims of the research to the participants. No one refused to participate.

In addition, the four trustworthiness criteria recommended by Lincoln et al. (2011) were used: (a) credibility, through systematic observation for 6 months; (b) transferability, through the dense description of the contexts and populations studied; (c) dependence, through triangulation and reciprocal use of techniques and instruments to provide greater neutrality; and (d) confirmability, by exposing the interests of the research team from the beginning and, also, triangulating the sources and instruments.

4. Results

The results are divided into four main categories: (a) interpersonal relationships between students of cultural minority groups, (b) interpersonal relationships between cultural minorities students and non-cultural minority children, (c) interpersonal relationships between SCSP teachers and cultural minority students, and (d) tensions generated by cultural stereotypes about the body and the practice of physical sporting activities. Each of these categories has its corresponding sub-categories. Furthermore, some illustrative textual quotations obtained from the observations and interviews are presented in each instance. **Table 2** contains the sources of data collection and their respective codes used to identify such sources in the categorization and subcategorization of the data and their corresponding codes of analysis. Also, a summary of the main results for each category can also be seen in **Figure 1**.

4.1. Interpersonal relationships between students of cultural minority groups

This category represents the social interactions of immigrant and Mapuche-Huilliche participants on each case study, specifically: (a) the relations between the immigrant students within the Spanish program; and (b) relations between the Mapuche-Huilliche students and their immigrant companions.

Both case studies, the results show the existence of particular dynamics and types of interplays that stem from the respective cultural identity. In this sense, two subcategories emerged:

TABLE 1 Emerged categories and subcategories of analysis.

Categories	Subcategories
Interpersonal relationships between students of cultural minority groups.	Relationships between immigrant students in Spanish context
	Relationships between Mapuche-Huilliche and immigrant students in Chilean context.
Interpersonal relationships between cultural minorities students and non-cultural minority children.	Relationships between immigrant students with native Spanish children.
	Relationships of immigrant and Mapuche-Huilliche students with Chilean children non-member of cultural minorities groups.
Interpersonal relationships between SCSP teachers and cultural minority students.	Relationships between SCSP teachers and immigrant students in Spanish context.
	Relationships of SCSP teachers with Mapuche-Huilliche and immigrant students in Chilean context.
Tensions generated by cultural stereotypes about the body and the practice of physical sporting activities.	Tensions caused by cultural stereotypes in Spanish context.
	Tensions caused by cultural stereotypes in Chilean context.

TABLE 2 Sources of data collections and their corresponding codes of analysis.

Sources of data collection	Codes
Observation class of SCSP – Spanish context – class number.	O-SP-N
Observation class of SCSP – Chilean context – class number.	O-CH-N
In-depth interview – coordinator SCSP – Spanish context.	DI-C-SP
In-depth interview – coordinator SCSP – Chilean context.	DI-C-CH
In-depth interview – parents – Chilean context – person number.	DI-P-CH-N
In-depth interview – teacher of SCSP – Spanish context – person number.	DI-T-SP-N
In-depth interview – teacher of SCSP – Chilean context – person number.	DI-T-CH-N
Group interview – male immigrant – Spanish context – person number.	GI-MI-SP-N
Group interview – female immigrant – Spanish context – person number	GI-FI-SP-N
Group interview – male immigrant – Chilean context – person number.	GI-MI-CH-N
Group interview – female immigrant – Chilean context – person number.	GI-FI-CH-N
Group interview – male Mapuche-Huilliche – Chilean context – person number.	GI-MM-CH-N
Group interview – female Mapuche-Huilliche – Chilean context – person number.	GI-FM-CH-N

(a) relationships with immigrant students in Spain and (b) relationships between students belonging to the Mapuche-Huilliche ethnic group in Chile.

4.1.1. Subcategory: Relationships between immigrant students in Spanish context

Although immigrant students come from different nationalities, they all see themselves as outsiders with regard to the main culture. As such, they must endure discriminatory situations that are associated with their common circumstances (e.g., being called "foreigners" or having segregation experiences at school). Curiously enough, this not only promotes a sense of belonging and cohesion, but also encourages the existence of specific codes of communication and identity among these groups.

An example of the aforementioned dynamics is what happens when new immigrants begin to participate in the SCSP program. Those who have more experience in the program develop welcoming and solidarity practices, based on empathy toward their new immigrant peers. These attitudes of collaboration are not observed when new Spanish children arrive, which shows that relations between immigrant students have specific characteristics. Following are two instances:

> *We are all from other countries, so we help each other* (GI-MI-SP-03).
>
> *Today a new foreign student arrived. He does not speak Spanish and has difficulties understanding the teacher's instructions. However, other foreigners helped him, accompanying him in the activities* (O-SP-12).

Furthermore, there are subgroups of immigrants usually made up of students who come from similar places (South America, Central America, North Africa, etc.) or who share a common language. These aspects facilitate communication and a shared sense of identity among these individuals, as well as facilitating cohesion within these sub-groups.

In fact, there are subsets of immigrants who use their native languages to communicate during SCSP sessions for two main reasons: (a) when they want no one else to understand what they say and (b) to take advantage of some sports situation (e.g., when discussing a strategy to score a goal).

> *Two students from Morocco speak in Arabic. Apparently, they are making a plan to score a goal, without the rivals knowing how. They have confirmed this assumption of mine when I asked them afterwards* (O-SP-19).

In some SCSP sessions, conflicting situations were generated among immigrant students. In most cases, they were resolved, peacefully, through dialogue; however, sometimes it was observed that some migrant students wanted to resolve conflict situations through physical and/or verbal violence, assuming that these practices are normal and legitimate: *"Today, a just arrived immigrant student got angry when a classmate made a mistake, and pushed and threated to throw a punch at him"* (O-SP20). This, no doubt, negatively conditioned personal relationships. Nonetheless, it was observed that, as the program advanced, these aggressive behaviors diminished and practically stopped at the end of the year.

4.1.2. Subcategory: Relationships between Mapuche-Huilliche and immigrant students in Chilean context

The interpersonal relationships of Mapuche-Huilliche students had singular characteristics that differentiate them from other types of interactions. To a great extent, these can be associated with the cultural particularities and the worldview of this ethnic group-aspects that, logically, transversally affected the relationships developed by these individuals with respect to the rest of the group of students.

Although the Mapuche-Huilliche people have their own language, students hardly use it to communicate. When asked why, they expressed that they cannot speak in their ethnic language because, when they do so, (a) teachers forbid it and, at times, punish them for doing so, and (b) their non-Mapuche classmates reject them. Here are examples of both:

> *I do not talk [in Mapuche-Huilliche language] at school* (GI-FM-CH-01).
>
> *Last year, a teacher told me that everybody in school had to speak in Spanish, because it is the language spoken in Chile* (GI-MM-CH-03).

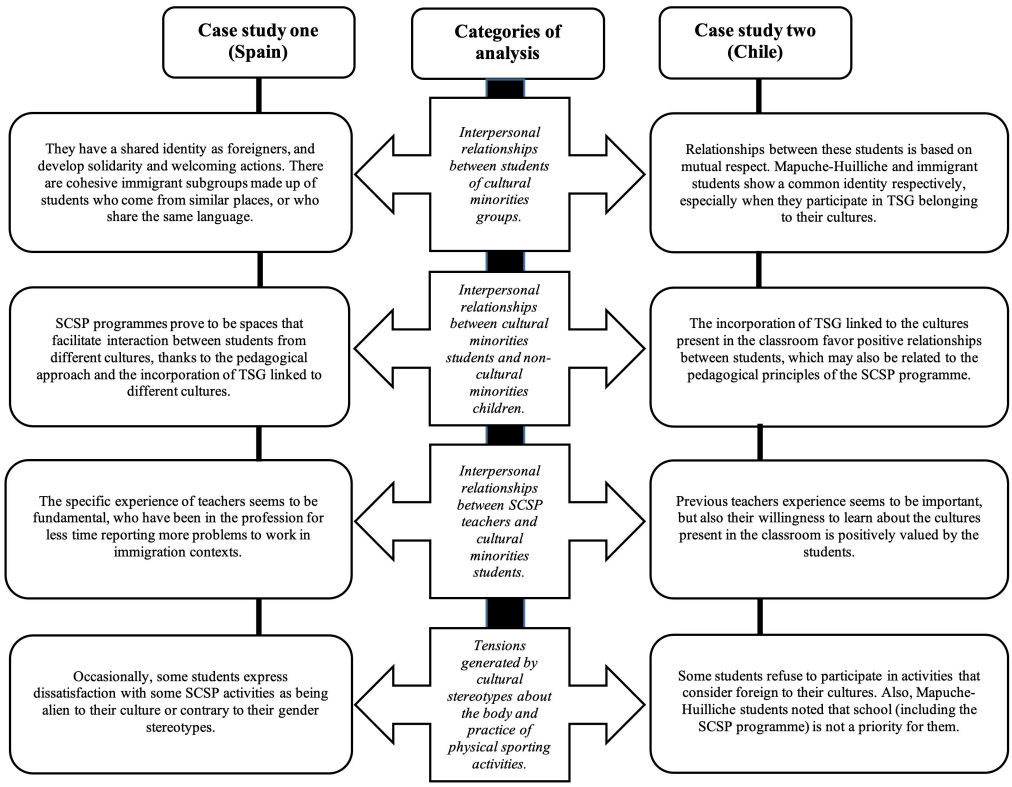

FIGURE 1
Summary of study results.

> *My classmates will make fun of me [if they hear me speak in Mapuche-Huilliche language]* (GI-MM-CH-06).

However, it can be observed that these students share some discourses and practices that are configured as symbols of a shared identity and provide them with a sense of belonging to the Mapuche-Huilliche culture. Concretely, these students show a high sense of group cohesion when TSG linked to their ethnicity are incorporated into the program. This implies that these activities are configured as elements and identity traits of their culture, showing that these students recognize themselves as part of a particular group: "*Today games of the Mapuche-Huilliche ethnic group are held, the students of that culture show interest in the activity and try to be teammates, expressing that the game belongs to them*" (O-CH-33).

Moreover, the relations between Mapuche-Huilliche students are built mostly on a framework of mutual respect, although there are some conflicts. There is a number of minority students that seek being protagonists by demonstrating their skills in some sports practices. When these students are new to the program, they tend to aggravate their older teammates who might be less skillful in game situations.

The sporadic conflicting episodes among these students tended to decrease gradually as the school year progressed. These situations, however, were not observed among Mapuche-Huilliche students who had been participating in the program for longer. Both situations may be related to the promotion (or lack thereof) of educational values and the use of cooperative learning strategies that promote the positive interdependence of students within the program: "*I used to fight him [referring to another Mapuche-Huilliche student], but now we get along because we play together*" (GI-MM-CH-04).

In this sense, the relationships between immigrant students are mostly based on respect. Despite coming from different countries, they seem to recognize each other as having a common identity as foreigners, as is evident in the following sentence from an immigrant student: "*we became friends, because we are both from another country and we have another culture, we like other games (. . .) we miss our countries too (. . .) we are similar*" (GI-FI-CH-02).

Conflicts also develop between immigrant students, especially on those occasions of play where some children perceive themselves as less competent than others. On some minority occasions, they also argue when, as a result of some play action, one classmate makes fun of another.

> *We are friends (other foreign peers), but sometimes I get angry when things don't work out when I play, even more so when my friends laugh at me* (GI-MI-CH-01).

Interactions between Mapuche-Huilliche students and children from other countries are based on respect for differences. There are also practices of mutual support between them, where at times it is observed that they all recognize each other as members of cultural minorities, as a Colombian student points out: "*here everyone should have the right to live their culture (. . .) but in Chile sometimes they discriminate against us, as happens to our classmates who are*

Mapuche" GI-MI-CH-03. Although there are also conflicts over play situations, for the same reasons as mentioned above (teasing in play situations or reproaches when a classmate makes a mistake).

4.2. Interpersonal relationships between cultural minorities students and non-cultural minority children

This category focuses how social relationships are configured between cultural minorities individuals with other children in both studies and shows how this affects the inclusion processes. Here also are two subcategories: (a) social interactions that immigrant students develop with native Spanish children and (b) relationships between Mapuche-Huilliche and non-Mapuche-Huilliche students.

4.2.1. Subcategory: Relationships between immigrant students with native Spanish children

As mentioned above, immigrant and native students attend Friday sporting events, where students from different schools participate. Here, the relationships between students of foreign origin and Spanish students are, basically, based on mutual respect, despite the fact that both groups hold different worldviews, cultural habits and nationalities: "*In all teams there are children of different nationalities. Spanish and foreign children have played the whole class with no conflict*" (O-SP-26).

One of the reasons for such harmony might be that everyone participates in games for pedagogical purposes, where there is no record of results or classifications. The teams are always composed of boys and girls from different educational centers, aiming to promote equality between them. This is also the case with teams composed of natives and immigrants. The lack of conflict seems to point out the success of this pedagogical methodology, which fosters the acquisition of new social capital, positive social interactions among all, and the creation of networks among the individuals of all groups. It is possible then, that favors the interaction of students with different cultural backgrounds from a pedagogical framework that promotes the development of intercultural values (focusing on respect and positive valuing of cultural diversity) and without to accentuate competitiveness (through the reduction of rivalries, without generating winners and losers), be the key to reduce the risk of conflicts. This is evidenced in this quote: "*I made several Spanish friends on Friday, they are from other schools, very 'cool.' They are so funny*" (GI-MI-SP-13).

However, occasionally, there emerged some conflicts accompanied by ethnocentric discourses due to the mutual prejudices between immigrants and natives. For instance, some Spanish students expressed derogatory opinions toward their immigrant peers, assuming that because of their foreign status the latter are intrinsically inferior (especially if they come from poor countries). Oddly enough, this led to a few cases where immigrant students publicly deny their foreign origin so as not to be discriminated against.

> *A Spanish student tells another classmate: "these blacks are useless," regarding a fellow immigrant who made a mistake during the game* (O-SP-08).

> *A Colombian child refuses to come from that country several times, does not want to be discriminated against. [He arrived two years ago to Spain]* (O-SP-14).

In turn, there was similar language used by some foreign students against their Spanish peers, generating even more distress and some threats against them regarding the sporting activities or for other reasons. However, in this regard, it must be said that most of these cases were instigated by students who had been in the program for a significantly short time (less than 3 months) and were still unfamiliar with the educational values taught there. Also, it was one case in which a novice teacher whose lack of experience prevented him from anticipating and aborting the conflict.

4.2.2. Subcategory: Relationships of immigrant and Mapuche-Huilliche students with Chilean children non-member of cultural minorities groups

The relations between Mapuche-Huilliche and migrant students with the rest of their classmates were usually carried out, also, on the basis of mutual respect. Among the aspects that favored such positive relationships should be mentioned that of the incorporation of TSG associated with Mapuche culture and countries of foreign students during the classes:

> *The Mapuche-Huilliche children know better the "games" of their ethnic group, the other classmates approach them, and ask them for help to learn* (O-CH-34).
>
> *My son says he likes it when the teacher plays games from our country (. . .) he teaches the other classmates how to play (. . .) the other children want to play with him* (DI-P-CH-02).

Another contributing factor may have been the introduction of cooperative activities, which fostered the coexistence of students and their acquisition of more social capital, especially during the meetings on Fridays, when students from other educational centers met. Here is one testimony in this regard:

> *I like it when we go to other schools on Fridays, I met several guys with whom we sometimes get together to play soccer in the afternoons* (GI-MM-CH-05).
>
> *Since we arrived in Chile, my son had had problems making friends, but since he started playing sports at school that changed, he got to know his classmates and kids from other schools better* (DI-P-CH-03).

The program continuously promoted social values and a positive classroom climate, however, isolated situations where negative social interactions developed among these students. Mapuche-Huilliche students and immigrant were sometimes discriminated against for cultural, racial, and socioeconomic reasons.

> *A child tells the teacher that he does not want to play on the same team as two Mapuche-Huilliche students, expressly saying "those Indians are useless" in a dismissive tone* (O-CH-10).

> *In one class, a Chilean boy says "I don't want him on my team [a immigrant classmate], let him go to his country [he laughs mockingly], they are bad at playing ball [referring to football]"* (O-CH-09).

4.3. Interpersonal relationships between SCSP teachers and cultural minority students

This category deals with the relationships that SCSP teachers established with immigrant students in study one, and with Mapuche-Huilliche and immigrant students in study two. We show how these interactions either favor or hinder the process of social inclusion processes.

4.3.1. Subcategory: Relationships between SCSP teachers and immigrant students in Spanish context

The relationships between teachers and immigrant students are different in each school. In this case study, a high level of teachers' professional experience seems to be decisive in this sense, regardless of the number of immigrants that exists in their class. More novice teachers tended to have more problems with immigrant students: *"It is difficult for me to work with these [immigrant] children; they are undisciplined, and I do not know what to do with them"* (DI-T-SP-04).

Both the program coordinator and some teachers stated that they did not receive sufficient specific training to work with immigrant students. This is a worrying reality. It is not logical that the skills needed to manage adequate intercultural coexistence among the students may depend on whether teachers have acquired these on their own. This is evident to the program coordinator: "*Our teachers do not receive any training to work with immigrants, although the oldest ones have more experience in this regard*" (DI-C-SP).

The experienced SCSP teachers usually incorporated TSG linked to the countries of origin of their immigrant students and tended to be intolerant of situations of discrimination against immigrant students. "*I have experience working with foreign children. I am old in the programme. I use some games that [immigrant children] teach me*" (DI-T-SP-02). Foreign students valued these aspects positively.

4.3.2. Subcategory: Relationships of SCSP teachers with Mapuche-Huilliche and immigrant students in Chilean context

The teachers of this SCSP program did not have any university training to work in cultural diversity contexts (even though one of the teachers had experience with foreign students), but received a basic training to work into the SCSP program. In this sense, the relations between these students and teachers were usually cordial. The students appreciated that the teachers show respect toward, and interest in, the Mapuche culture and traditions of other countries represented by immigrant students, in addition to a positive predisposition toward the learning of elements linked to it:

> *My son told me that he likes to come to SCSP because now the teacher makes them play our [Mapuche-Huilliche] games* (DI-P-CH-01).
>
> *At the beginning (first weeks) I was a bit bored, but now I like coming here (. . .) the teacher does things similar to what we used to do in my country (. . .) I haven't played my favourite games for a long time* (GI-FM-CH-02).

This attitude toward the teachers was perceived as atypical and surprising (especially for Mapuche-Huilliche students), but favored positive relationships. In fact, during the implementation of typical games linked to the Mapuche people or immigrant children, teachers are open to receiving criticism and suggestions from students belonging to this cultural groups, generating a bidirectional learning space, where teachers and students learn from each other. Although the teacher's previous experience proves to be an important factor in developing positive relationships.

> *During class, a Mapuche-Huilliche student explains to the teacher how to play [a Mapuche game], the teacher listens attentively and thanks him* (O-CH-35).
>
> *When my son started to go [to SCSP], he didn't like the teacher [the younger teacher without previous experience with cultural minorities]. He said that sometimes the class was very chaotic (. . .). His older brother told me the same thing (. . .) but the other teacher [who did have previous experience in such contexts] was nice* (DI-P-CH-03).

4.4. Tensions generated by cultural stereotypes about the body and the practice of physical sporting activities

In both research scenarios, subjects, and groups with different worldviews and cultural practices converge. By virtue of this dynamic, there are situations where tensions or differences are observed around habits and beliefs linked to sports practice. This category presents these situations in both settings. First, we will discuss the cultural tensions experienced by immigrant students in the Spanish program, and then, later address the cultural tensions experienced by Mapuche-Huilliche and immigrant students in Chile.

4.4.1. Subcategory: Tensions caused by cultural stereotypes in Spanish context

In the first case, immigrant students usually expressed a positive opinion about the SCSP program, although sometimes situations arose that contradict the codes and cultural worldviews of their places of origin. In concrete terms, it was observed that some immigrant girls (particularly from Latin America, Eastern Europe, and North Africa) refused to participate in some activities proposed by the teachers for considering those inappropriate for women: "*I cannot play that, they are games for men, if my mother or father saw me, they would be angry*" (GI-FI-SP-01). Curiously, some male students also considered that certain activities (e.g., football) were exclusively for males, resisting the fact that in the SCSP program

these activities were organized for both genders. As described above, this revealed the existence of cultural gender stereotypes regarding physical expression and sports practice. It is important to mention that the teachers of each educational center promoted gender equality for all groups, natives and immigrants alike.

Also, there were immigrant students who rejected sports practices that were alien to their culture of origin. When they did not know any TSG or did not understand them, they preferred not to participate in those activities. This situation, as well as the resistance toward certain sports for reasons of gender, affected, at first, the levels of participation of immigrant students, hindering the social inclusion process: "*The teacher makes us play weird things, those sports are not played in my country, I do not like them*" (GI-MI-SP-08).

4.4.2. Subcategory: Tensions caused by cultural stereotypes in Chilean context

In the second case study, as with the Spanish case, some tensions were caused by culture stereotypes in the classes and sport meetings around three dimensions that hindered social inclusion processes (because of the impact on interpersonal relationships and student participation).

First, there was a lack of interest on the part of Mapuche-Huilliche students to participate in activities that they deemed as alien to their context and culture. It was the same for some foreign students, who during the first weeks did not want to participate in games they had little mastery of.

> *I do not like these sports [referring to modified rugby and hockey games]. We have never played them and do not know the rules (. . .) are from other countries* (GI-MM-CH-04).
>
> *Today some children (coming from other countries) tell to teacher, they don't want participate into the class games (. . .) they say that are "freak games" and boring (. . .) they never played them in their country* (O-CH-07).

Second, some immigrant and Mapuche-Huilliche students were reluctant to participate in some activities because of gender prejudices. That is, from their particular worldview, they considered certain bodily practices inappropriate for men or women. In short, they established what is culturally legitimate for each gender in terms of physical expression, as well as those behaviors that are improper and that can generate social disrepute if they are practiced (e.g., for them, it would be inappropriate for a girl to play football because they considered that to be unsuitable for females):

> *There are girls who do not want to participate in some activities, they have complained that in some classes there are only activities for men* (DI-C-CH).
>
> *My mother and grandmother tell me that some games are not for girls. That's the way in my country* (GI-FI-CH-02).

Third, some Mapuche-Huilliche students openly stated that school is not a priority for them. For them, the most relevant educational process is one that is built within the indigenous communities themselves, where alternative types of knowledges are promoted. Some Mapuche-Huilliche students considered that many contents taught in school, including some of the SCSP program, insignificant to their lives.

> *Mapuche-Huilliche students sometimes tell me that at school they do not learn anything important, for them and their families it is more important what they learn in their culture (. . .), that is why sometimes they do not come to school* (DI-T-CH-01).

5. Discussion

Regarding the interpersonal relationships between students of cultural minorities groups, the results show that participation in these SCSP programs, for the most part, had positive effects in terms of social inclusion in both contexts. Although in both settings existed conflicts, especially stemming from the prejudices of natives and the newcomers, who were not yet familiarized with the SCSP principles and dynamics, the interpersonal relationships of this students could be considered as positive, especially considering the collaborative solidarity practices and empathy demonstrated during the classes and meetings. This may be due to the use of learning activities, focused on the development of social cohesion, cooperation, and non-competitiveness; as well as the introduction of TSG belonging to the cultures of the minority groups and the sport motor competence that students display. Previous research shows that such practices not only are recognized as strengthening symbols of cultural identity for immigrant and native ethnicities, but also promote harmonious social relationships among individuals from different origins and traditions even in communities without immigrants or indigenous peoples (Román, 2010; Carter-Thuillier et al., 2018; Berti and Lapiccirella, 2019; Puente-Maxera et al., 2020). In short, TSG are cultural traditions and symbols (Martín-Martínez et al., 2021) that allow, through physical-playful experiences, the conservation of identities and the positive exchange between them based on corporeality (Parlebas, 2020). Therefore the use of TSG in the classroom is a concrete way of recognizing the different cultures present in the context, assuming then, that human action and motricity are indivisibly linked with culture (Martínez-Santos et al., 2020).

In both contexts, students are fluent speakers of Spanish, enabling communication between them. However, Spanish is spoken because institutional contexts force students to speak it, the official language, and Mapuche students are discriminated against if they speak their traditional language. Therefore, students have no choice. The above, in addition to the systematic exclusion and pauperization of Mapuche culture into the Chilean schools (Turra et al., 2017; Nahuelpan and Antimil, 2019; Poblete et al., 2020), may be affecting that students belonging to the Mapuche-Huilliche ethnic group show a progressive loss of their ancestral language and partial ignorance of their TSG is a worrying sign. In the same direction, the literature suggests that negative acculturation processes sometimes take place from the dominant culture (Berry, 2017), particularly when subordinate relations are established with minority groups, affecting the development and conservation of their cultures (Banks, 2016); this could explain the weakening of the Mapuche-Huilliche culture and its ancestral language (Williamson et al., 2012). For this reason, it is positive that SCSP programs

examined in this study used TSG linked with all cultural identities in classes and meetings, since different authors (Dubnewick et al., 2018; Berti and Lapiccirella, 2019; Luchoro-Parrilla et al., 2021; Saura and Zimmermann, 2021) have pointed out the need to promote the development of cultural identities through immaterial aspects such as TSG. Moreover, it is a learning opportunity for all students and positively valued by both native and cultural minority students.

In terms of interpersonal relationships between cultural minorities students and other children, the results show that both SCSP programs promoted positive relationships by facilitating the development of new social networks among the members of different cultures, which otherwise would not exist. This is consistent with other previous studies conclusions (Verhagen and Boonstra, 2014; Smith et al., 2019; Flensner et al., 2021; Ekholm et al., 2022), stating that sports activities among subjects of different cultural and ethnic origin encourage the acquisition of social capital for all individuals, promoting the cultural capital (re)production of identities into the context, and then allowing the processes of social inclusion (Spaaij, 2012; Mohammadi, 2022). In this vein, other researchers have suggested that sports can be a privileged medium for the development of intercultural competence in children students (Grimminger-Seidensticker and Möhwald, 2017). Needless to say, these researchers' conclusions ought not to be admitted at face value. There are certain limitations, which, in fact, were obvious in both SCSP programs, where conflicts did emerge and which were directly related to ethnocentric ideologies, discourses and practices (Banks, 2016), in addition, according to the study findings, children who have low sport motor competencies may face somewhat more complex processes in this respect. However, the incorporation of TSG linked to the cultures present in each context proved to be an effective strategy to favor rapprochement and relations between students. According to Saura and Zimmermann (2021), this can be explained because incorporate TSG of all identities is synonymous to recognize each culture and members of them, also an opportunity to promote rapprochement, dialogue, learning, and socially inclusive climates. However, it is always important to critically analyze these inclusive alleges properties of sport, as in many cases specific skills are required to take part in them, as well TSG are gender-stereotyped also.

As for the interpersonal relationships between SCSP teachers and cultural minorities students, these case studies data indicate that, in both contexts, educators would have benefited from specific training to work in culturally diverse contexts. This lack of training can be made up with prolonged experience in pluri-cultural contexts; although, for those who do not have it, it is very difficult to prevent and solve conflicts, especially those related to intercultural and inter-ethnic situations (Flores et al., 2014; Wyant et al., 2020). Furthermore, this shortfall has negative effects on students, regardless of their cultural or ethnic background. This was obvious, especially, in the case study carried out Spain. In relation to the above, different authors (Grimminger, 2011; Ko et al., 2015; Wyant et al., 2019, 2020; Doidge et al., 2020; Siljamäki and Anttila, 2021) have raised the need to include intercultural competence in the training of PE teachers and Sport Coaches, because otherwise they might have initial problems in working in culturally diverse contexts and also difficulties in helping their students to acquire intercultural skills. Likewise, studies (Carter-Thuillier et al., 2018; Pic et al., 2019; Puente-Maxera et al., 2020; Martín-Martínez et al., 2021; Lavega-Burgués et al., 2023; Moya-Higueras et al., 2023) related to TSG show that its use in the classroom represents an effective way of incorporating different cultures into the school, in addition to generating positive effects on different socioemotional and motor variables, however, the need for teachers who are sufficiently prepared in this area is also exposed for authors. Therefore, it seems essential to specifically train teachers who intend to work with the use of TSG in intercultural contexts.

It became evident that participation in sport activities at school context not resolve full tensions about diverse cultural ideologies, discourses and traditions, it can sometimes even aggravate them if intercultural approaches are not used. The mere application of foreign cultural ideals about the body and movement can generate anthropological, sociological, gender-related, and theological tensions (Lenneis and Pfister, 2017; Thorpe et al., 2022). Some of this was evident at the beginning of SCSP programs. To prevent this, a specific intercultural pedagogy is essential to compliment the possibilities for intercultural understanding and cooperation that both schooling and sport offer. In this sense, different authors (Shea and Beausoleil, 2012; McSweeney and Hakiza, 2022; Thorpe et al., 2022; Truskewycz et al., 2022) raise the need to analyze how the body representations of immigrant and native groups are limited by dominant cultural traditions and institutions, for this reason overcoming cultural stereotypes in relation to sport and movement, especially those that segregate girls, requires a deep understanding of these cultural systems in order to succeed in this task, otherwise resistance from members of these cultures is likely to be encountered.

6. Conclusion

Both programs demonstrate favor social inclusion processes in culturally diverse contexts, facilitating the creation and development of interpersonal relationships between students with different cultural identities, interactions that are mostly based on mutual respect and support. However, there are also conflictive situations, especially during the initial commencement of each program (perhaps because the students were not yet adapted to the methodological proposal of the programs), as well as prejudice and reciprocal discrimination between children who belong to cultural minorities and those who do not in both contexts. In addition, the sport motor competence level of each student seems to have an impact on socialization processes, who are less proficient experience more complex processes in this regard.

The incorporation of TSG belonging to all the cultures present in the context, as well as the experience and level of preparation of the teachers to work in intercultural educational environments, seem to be determining aspects to favor the processes of social inclusion. However, considering the findings of this study, the stereotypes that each culture has about sport and movement also prove to be a determining aspect to consider, especially when become a reason for exclusion or segregation (as sometimes happens with girls in both cases). However, it is also essential to look closely at TSG and their gender-stereotyped, because they can exacerbate conflicts and segregation situations.

The findings of this multi-case study are only valid for the contexts where the research was carried out. However, although the reality of cultural minorities is subject to the particularities of each social space, the results of this research indicate that in both contexts there are similar aspects that favor and hinder the processes of social inclusion, and also that after-school SCSP programs can enhance them when proposals focused on the development of socio-educational values are developed.

In closing, constructing a specific pedagogy based on these findings might be useful to teachers and sports coaches who work in contexts of cultural diversity, especially in scenarios with pluri-ethnic and multi-national students. This research can also be suitable to professionals in the Social Sciences, whose interest is in the education and social relations of immigrant and native ethnic groups.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the Academic Committee of the Doctoral Program in Transdisciplinary Research in Education at University of Valladolid (Spain) and the Bioethics and Biosafety Committee of the Universidad de Los Lagos (Chile). Written informed consent to participate in this study was provided by the participants and legal guardians as appropriate in each case.

Author contributions

BC-T, VL-P, and FG-F defined the design, participated in the data collection, and wrote the manuscript. JC-B and J-MF-B participated reviewing the methodological design and collaborated to edit and write the manuscript. PD-F, EG-S, and AS participated on the manuscript writing and contributed to the final data analysis. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Relationships between empathy and creativity in collective games: a comparison between handball and sitting ball

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In collective motor situations, creativity and empathy are central and strongly connected to cognitive and affective processes. Indeed, in the environment of high social uncertainty of games and sports, empathy would allow the player to anticipate motor behaviors in order to promote creative decision-making, i.e., to destabilize his opponents. On this basis, this study pursues two objectives. The first is to propose indicators to question the links between sociomotor empathy and motor creativity in an ecological situation. The second is to investigate the potential influence of the internal logic of two very different collective games (handball and Sitting ball) on the type of links that are woven between empathy and creativity. Two groups of students were recruited (n =22 and 23) and participated in each of the games mentioned. The games were video recorded. The praxical communications made by each player were recorded and sorted by two trained observers. The results revealed major differences between the two studied collective games. In handball, there was a correlation between instrumental empathy (valuing cognitive aspects) and indicators of motor creativity (p<0.05). The more creative the players are (quantity, diversity and quality of performance), the more they manage to accurately anticipate the behavior of other players. In Sitting Ball, there was no correlation between creativity indicators and instrumental empathy. On the other hand, it is noticed that instrumental empathy was correlated with socio-affective empathy (p<0.001). To make their motor decisions, the players do not rely exclusively on the decoding of behaviors but significantly mobilize the feelings that they ascribe to the other co-participants. The results of this work invite reflection on the diversity of playful reading grids to be offered to students in order to develop their motor adaptability.

KEYWORDS

motor creativity, sociomotor empathy, instrumental empathy, socio-affective empathy, motor situation

1. Introduction

In collective games, creativity and empathy are central and strongly connected to cognitive and affective processes (Parlebas, 1999; Jihyun et al., 2020; Oboeuf et al., 2020, 2022). First of all, creativity refers to the ability to generate new, original work that is meaningful in its context (Amabile, 1996; Runco and Jaeger, 2012; Anderson et al., 2014; Fardilha and Allen, 2020).

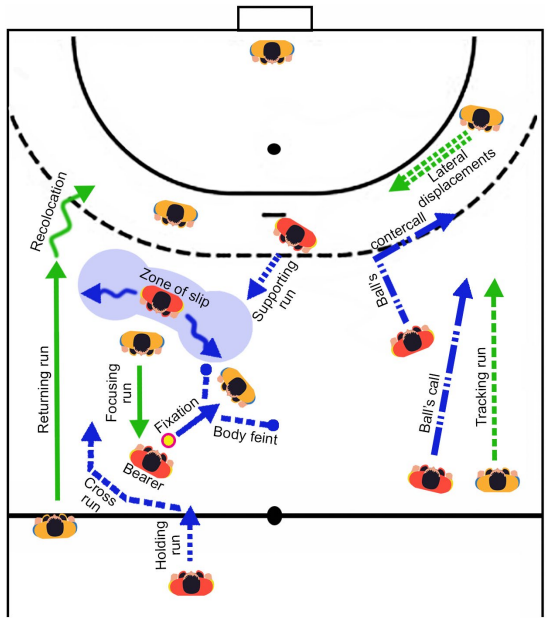

FIGURE 1
The sign system of handball. The main praxemes mobilized by handballers during the game. Two praxemes do not appear on the figure. (i) "Shooting feint"; (ii) "Passing feint."

During the game, participants are continuously adapting to the constraints of the internal logic by interpreting the behavior of their partners and their opponents (Parlebas, 1999; Oboeuf, 2010; Furley and Memmert, 2018). Teammates must be creative and unpredictable in order to individually and collectively thwart opposing projects (Oboeuf et al., 2009; Furley and Memmert, 2018; Rasmussen et al., 2019). This motor creativity is based on empathy, understood as the ability to put oneself in the place of others, i.e., to anticipate their feelings and/or their thoughts and/or their behaviors (Courchet and Maucorps, 1966; Berthoz and Jorland, 2004; Stanger et al., 2016). In the environment with high social uncertainty of games and sports (Márquéz Jiménez and Martínez de Santos, 2014), this empathetic mechanism would enable the player to pre-act, to anticipate behaviors in order to improve his creativity, in particular by increasing his ability to surprise opponents (Rasmussen et al., 2019; Oboeuf et al., 2020). In collective games, these two mechanisms are closely linked and yet there are few studies focusing on their interdependence. Therefore, our aim is to explore how empathy and creativity are intertwined in collective sporting games. First, it seems important to us to define more clearly the two central concepts involved.

2. Motor creativity and sociomotor empathy

2.1. The motor creativity

Motor creativity can be observed in an ecological situation (Oboeuf et al., 2020). To assess *in situ* the level of creativity of the players, it is necessary to know the structure of the communications that the players can use during the game. Indeed, creativity is dependent on the context, on the "frame" (Goffman, 1974), which channels motor behaviors and makes it possible to understand players' strategic choices (Pic et al., 2018, 2020). We do not communicate in the same way during a basketball game or a dodgeball game (Parlebas, 1999; Collard, 2004; Pic et al., 2019), but the creative player is always the one who, within a given set of constraints, will succeed in putting the adversary in difficulty in his communication choices.

In team sports and traditional sporting games, praxical communication is divided into two main interdependent categories (Parlebas, 1999). The first concerns direct communication. This is often the only worthy of interest, because it is closely linked to the performance of the motor task: it involves a direct relationship to the object (pass, shot, interception, etc.) or to the body of the partner or of the opponent (contact, touch of capture, touch of delivery, etc.). This is the first-degree interpretation of the behavior of practitioners (Oboeuf et al., 2009). The second category concerns the signs (or praxemes[1]) which serve as a support for these direct communications and ensure the overall dynamics of the game: we name it indirect communication. In handball, the "focusing run" is a sign: if a player produces an approach run to reduce an opponent's possibilities of action, the "running" behavior will be the signifier. The message or signified, meanwhile, will be the attempt to dissuade the player aimed at reducing his ability to move or to force him to separate from the ball. For a given game, all these praxemes are organized into a system (Figure 1). The analysis of this system of signs comes under the semiology of motricity, that is to say semiotricity (Parlebas, 1999; Bordes, 2020; Lavega-Burgués et al., 2022; Martínez-Santos et al., 2022; Parlebas, 2022). This semiotricity offers the opportunity to better understand the diversity of motor behaviors used by participants *in situ*. Understanding this communicational diversity is an issue but also a necessity to understand creativity in collective games. In effect, to be creative during the game, players must adapt to this system of signs, "this secret code" (Oboeuf et al., 2019, 2022), by assigning the right meanings to the behaviors of other players. *De facto*, mastering this code, made up of praxemes and their possible articulations, is an issue for promoting motor creativity (Oboeuf et al., 2020). In collective games, motor creativity means: (1) the ability of a player to mobilize a large number (fluency) and a large variability (flexibility) of direct and indirect communications (praxemes), i.e., to demonstrate praxical divergence. This is the quantitative side of creativity and (2) the ability to make the right motor decisions on a temporal sequence of play, i.e., to demonstrate praxical convergence. This corresponds to the overall ability of the player to propose diversified, elaborate, original but also adapted motor responses during the game (Memmert et al., 2013; Lubart et al., 2015; Zhu et al., 2019). This is the qualitative side of creativity. The creative player is able on the one hand, to energize the game by multiplying and diversifying the communications, and, on the other hand, to make the best possible decisions. He is the one who proves to be the most capable of weakening the opposing balance by proposing new responses adapted to the context in which they appear (Lubart et al., 2015; Furley and Memmert, 2018). It is important to specify that in a

1 The praxeme is a "motor behavior of a player interpreted as a sign whose signifier is the observable behavior and the signified the corresponding tactical project as it has been perceived" (Parlebas, 1999, p. 260).

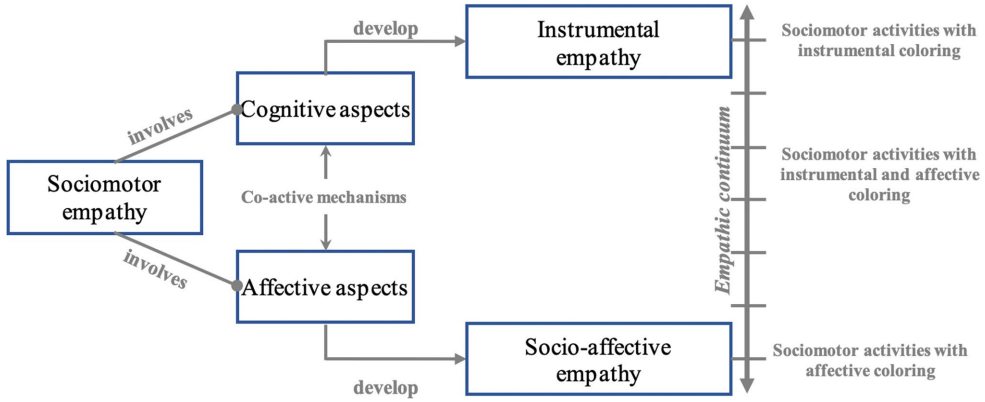

FIGURE 2
The two sides of sociomotor empathy. Empathy in sociomotor games is characterized by the co-activation of cognitive and affective mechanisms. The prevalence of one or the other of the corresponding empathy makes it possible to position each collective game on an empathetic continuum.

particular context, participants or groups that produce the most ideas or actions are often those that take the most adapted and original decisions (Lubart et al., 2013).

2.2. The sociomotor empathy

Players of collective games constantly make assumptions about motor behaviors. Some players shine in this area: they sometimes predict with a strong accuracy the future of the action in progress and influence its progress according to their projects. Sometimes they take the ball out from an opponent by "not falling" into the trap of his dribble. Sometimes they guess a pass line at the right time to intercept the ball. In other situations, they recover it with a skillful spatial positioning. Sociomotor games, in other words games with essential motor interactions (Parlebas, 1999; Collard, 2004), involve permanent anticipation. Each player is confronted with a large number of signs or praxemes (ball calls, cross runs, various feints, etc.) and must quickly make the best decisions. What does this adversary approaching me want to do? Should I pass the ball to my partner, who has just completed this cross run? And if an opponent anticipates this pass, would not it be better for me to dribble the one coming my way? The player thinks the other thinks he is going to act a certain way and even more than that, he thinks the other thinks he thinks! The anticipations of anticipations multiply on the playground… Behind these motor interactions are revealed fascinating and singular empathic mechanisms.

Parlebas advances the concept of sociomotor empathy, understood as "the process by which an interacting individual tries to grasp the point of view of another co-participant and takes it into account during his own motor behaviors of task resolution." (Parlebas, 1999, p. 134). In activities that take place in the presence of others, this sociomotor empathy allows the player to adjust his motor decisions according to the projects he attributes to his partners and/or opponents. To operate this decentration, the player mobilizes cognitive and/or affective resources (Figure 2). The cognitive mechanisms feeding sociomotor empathy (memory, speed of information processing, attention, perception and reasoning in particular) helps the player to appreciate speeds, distances, support positions, tactics, strategic operations or to decode signs (praxemes or gestemes[2]). Thus, the motor decisions of the participants are nourished by observable elements: the player picks up clues grouped into signs to understand the behavior of others players. For example, in handball, if the player having the ball directs his steps (index 1), his shoulders (index 2) and his gaze (index 3) towards a direct opponent while accelerating sharply (index 4), it is said to make a "fixation" (praxeme). Cognitive mechanisms play a key role in the decoding mechanisms during the game.

At the same time, affective mechanisms participate in the decoding activity and come to weaken or reinforce our initial perceptions. The reading of the emotions of others and their interpretations (Damasio, 2010; Lecroisey, 2023), but also the pleasure felt, the desire for success or the motivational states perceived *in situ* are all determining factors in our decision-making. Obviously, the cognitive and affective aspects are always co-activated in all sociomotor situations. However, we are hypothesizing here that this joint deployment turns out to be very variable depending on the game. Depending on the modes of interaction with the partner(s) and/or the opponent(s), according to the spatio-temporal possibilities offered, according to the presence or absence of one (or more) object (s) mediating the confrontation, depending on the existence or non-existence of a scoring system generating or not a competitive challenge, the deployment of one or other of the empathic skills will be increased. All collective games cannot be placed in the same basket. Each internal logic orients and shapes differently the actions of the players (Parlebas, 1999; Lavega et al., 2014).

Concretely, certain sociomotor activities mobilize cognitive aspects to a greater extent. This could promote the development of instrumental empathy, which is close to what is called the theory of mind (Premack and Woodruff, 1978; Duval et al., 2011; Carlstedt and Balconi, 2019). The latter is a cognitive capacity that would

2 The gesteme "corresponds to the attitudes, gestures, facial expressions, motor behaviors that are performed with the aim of transmitting either a request, or an indication, or a tactical or relational injunction by simple substitution for speech" (Parlebas, 1999, p. 155).

make it possible to construct a representation of the mental states of other individuals independently of affective factors. In particular, it makes it possible to predict behaviors. In the games concerned, the affective aspects are not absent – they can never be, but they are reduced due to the need for success in the task (competitive stake). Here, it is mainly the mastery of the game code (the praxemes and their articulations) that allows the players to act effectively, and not the fact of knowing the affects of others. In other sociomotor activities, where the goal is not competitive and the modes of interaction with others are more flexible, the affective aspects can take a more important place. In this case, we anticipate the behavior of others by also relying on the knowledge we have of their feelings towards us. The affective resonance of these collective games would allow the player to mobilize a socio-emotional empathy. We defend the idea that there is a co-activation of these mechanisms with a more or less strong prevalence of one or the other according to the endogenous logic of the activity. Based on the elements mentioned above, it seems relevant to propose an empathic continuum where each collective game, according to its level of instrumental and affective coloring, could be place (Figure 2).

This study focuses on two distinct collective games (handball and Sitting ball) in order to: (1) study the mechanisms of instrumental and socio-emotional empathy and (2) to question the relationships between these empathic mechanisms and motor creativity. Well known, handball is a sport, in other words a motor situation codified in the form of competition, and institutionalized (Parlebas, 1999). It is a "strictly competitive game": the final result decides between the winners and the losers. The need to win involves both being transparent to our teammates and concealing our plans from opponents. Attached to the expected gain of the game, time pressure forces on the players to permanently decode of a flow of motor behaviors. Thus, the internal logic of team sports would, in our view, favor the deployment of a rather instrumental empathy. Our opinion is that this is different in the traditional game of Sitting ball. It is a practice that has not received the institutional label. This game was chosen because it has no scoring systems and presents relational ambivalence and instability. This game can be considered as paradoxal. When I participate in a game of Sitting ball, there is no competitive stake and I can choose to cooperate or oppose the other participants according to my desires. Concretely, in Sitting ball, at a given moment, I can decide to pass or shoot the player facing me (ambivalence). Also, I can decide to pass the ball to a player that I have previously tried to "eliminate," or to shoot at a player to whom I have previously made a pass (instability). The freedom offered to participants seems greater than in handball, where exclusivity and stability freeze relationships with partners and opponents. Praxical code appears as less complex in some traditional games, but freedom seems greater there. This is the reason why we postulate that the role of the affective side is amplified in these games. The absence of competitive stake and the possible interactions allow players to rely on the knowledge they have of the feelings of others to anticipate their behavior. Socio-emotional empathy can play a key role in this.

Based on the above considerations, the proposed study had two objectives:

1. To propose a method to assess instrumental empathy in collective game situations.
2. To reflect on the links between the sociomotor empathy and the motor creativity in ecological situation.

In connection with these objectives, two hypotheses were formulated:

1. It is possible to construct indicators to assess the instrumental empathy of players *in situ*.
2. The level of motor creativity is correlated either with instrumental empathy or with socio-affective empathy. In Sitting ball, motor creativity would rather be correlated with socio-affective empathy while in sports, it would be more associated with instrumental empathy.

3. Materials and methods

3.1. Study design

The use of mixed methods enables the study of the scenario of playful specificity due to the relevance of the temporal order of motor events (Arias-Pujol and Anguera, 2017). Mixed methods allow the integral vision of the object of study, the flexibility of the conceptual framework, and the inclusion of new dimensions (Johnson et al., 2007), which is suitable for the analysis of motor creativity and sociomotor empathy in motor situations. This choice is justified by the work on purely quantitative aspects (calculations of empathy indices, number/diversity of praxemes and data quality control) with the use of qualitative aspects such as the design of a grid observation (in order to identify the direct communications and praxemes of each collective game) and the convergence assessment by trained judges (Storme and Lubart, 2012). For this, the use of mixed methods was justified by observational methodology, based on the categories of communications and the temporal structure of motor actions. An observational methodology is a methodological approach adapted to work on the ecological dimension in sport and physical education (Pic et al., 2018). More concretely, a quadrant III observational methodology was applied (Anguera and Hernández-Mendo, 2016). A design was applied that was: (a) nomothetic, as data on different players were recorded, (b) punctual, because the observation were raised in a precise moment, and (c) multidimensional, since different dimensions (criteria) were taken into account.

3.2. Participants

To carry out this research, we recruited 2 groups of 22 and 23 students ($n = 45$) in the Faculty of Sports Sciences at the University of Picardie Jules Verne in Amiens, in the Hauts-de-France region (France). Among these 45 participants, there are 16 female students and 29 male students. These were 2nd year students (M: 19.3 years; SD = 1.53). The students chosen for the study were all specialists in team sports (basketball, football, handball, rugby, volleyball, field hockey). On average, experience in practice was 6.3 years (SD = 2.47). More concretely, our inclusion criteria are as follows: (1) be in the second year of a faculty of sports sciences and (2) be a specialist in team sports (at least 3 years of federal practice before the study). The exclusion criteria

are as follows: (1) not being a specialist in team sports and (2) practice a collective sport at the federal level for less than 3 years. This research was conducted in accordance with the ethical principles of the Declaration of Helsinki and the recommendations of the ethics committee of Paris Descartes University (France). Notably, all students who participated in the study completed an informed consent document.

3.3. Procedure

The 2 groups of students specialized in team sports took part in 2 collective games: handball and Sitting ball. Each group participated, over two sessions, in each of the activities presented (30 min per game). Each of the 45 participants therefore played 60 min in each game over the two sessions. This represented 120 min of actual play per participant, i.e., 6,600 min to be analyzed for all players. The direct communications and praxemes of each participant were filmed, deciphered and sorted in order to calculate our indices of sociomotor empathy and motor creativity. Each part was recorded through the use of two cameras so that it was possible, in case of doubt among the judges, to resort to a second viewing angle. The recordings covered from the beginning to the end of the game. To carry out the data analysis, 20 students specialized in team sports and who did not participate in the study were trained in the recognition of the different communications in a game situation. This training contained 6 h of theoretical contributions and 10 h of practice. During the 6 theoretical hours, the students are presented with the different structural characteristics of collective games (ambivalent or exclusive network, stable or unstable, balanced or unbalanced, symmetrical or dissymetrical) but also the different categories of praxical communications (directs communications, praxemes and gestemes). The way in which praxical communications are articulated through the sequence of sociomotor sub-roles is also discussed. During the 10 h of practice, the students learn to spot the praxical communications and the sociomotor sub-roles of the players (videos) then will learn to spot, in pairs, the indicators of low creativity and high motor creativity. It is important to specify that in handball, there are 20 praxical communications (5 direct communications and 15 praxemes): shot, pass, interception, ball recovery, contact, recolocation, focusing run, supporting run, slip, ball's call, ball's countercall, holding run, cross run, fixation, lateral displacements, returning run, tracking run, body feint, shooting feint and passing feint. In Sitting Ball, there are 13 praxical communications (4 direct communications and 9 praxemes): shot, pass, interception, ball recovery, slip, ball's call, ball's countercall, approach run, recoil run, recolocation, body feint, shooting feint and passing feint. For this study, and for each actor, two observers were responsible for recording the communications of the actors *in situ* (fluidity and flexibility). The observers who note the data relating to the praxical divergence are not those who judge the overall performance (praxical convergence). In order to limit judgment biases, two other trained observers are in charge of this work.

3.4. Calculation of the three indices of motor creativity (FLU, FLEX and CONV)

To calculate the overall motor creativity index of each player, it is necessary to obtain a praxical divergence index and a praxical convergence index. For the first, we consider in each game the number of communications (fluidity) and the diversity of mobilized communications (flexibility). Praxical convergence, on the other hand, is an evaluation of the overall performance, that is to say of the player's ability to make the right motor decisions. For each player, it was carried out by two trained judges who must assign a score between 1 and 10. The player close to 1 is considered to be not very creative: he makes decisions that never surprise his opponents and destabilize his partners. The player close to 10 is considered as very creative: he makes decisions that surprise his opponents and help his partners. We consequently obtained 3 indicators of motor creativity: praxical fluidity (FLU), praxical flexibility (FLEX) and praxical convergence (CONV).

3.5. Calculation of the instrumental empathy index (IEMP)

In order to obtain an index of instrumental empathy in games, we propose to mobilize the notion of sociomotor sub-role, understood as "the basic behavioral unit of the strategic functioning of a sports game" (Parlebas, 1999, p. 344): "Dribbler," "Shooter," "Passer," "Receiver," "Dissuader" or "Interceptor" are some examples of sub-roles in handball (Oboeuf, 2010). In reality, the sub-role is a label that qualifies a particular relationship of the player to others, to space, to time and to a possible object, i.e., to the internal logic. It refers to a class of motor behaviors that groups together actions judged to be equivalent from a strategic point of view. It should be noted that instrumental empathy is omnipresent in the participant's motor decision-making, regardless of the sub-role assumed. However, we believe that certain sociomotor sub-roles are more closely linked to the empathic capacities of the player and that they are good indicators of it. In handball, we retain 3 sub-roles: "Dribbler," "Interceptor" and "Recoverer." If I recover the ball when my opponent tries to put me at fault, if I manage to give false information to my opponent in order to dribble him, or if I intercept the ball, I have significant empathetic acuity.

To calculate our Instrumental Empathy Index (IEMP), we summed the number of successful dribbles, recoveries and interceptions (r) and divided it by the number of attempted dribbles, recoveries and interceptions (t). This index evolves between 0 and 1 and it is maximum when r = t, i.e., when the player has succeeded in all the dribbles, recoveries and interceptions that he has attempted. In Sitting ball, we relied on the "Dodger" and "Shooter" sub-roles. The player who manages to hit his target manages to anticipate his movements, and the one who manages to dodge an opposing attempt guesses his opponent's intentions. We can classify for each of the two games the players from the most to the least at ease in these exercises of sociomotor decentering. It then becomes possible to perform a correlation calculation between the indices of instrumental empathy and the three indicators of motor creativity (fluidity, flexibility and convergence).

3.6. Calculation of the socio-affective empathy index (SAEMP)

In order to question the place of the affective factors associated with empathy in the two chosen games, we ensured the passing of a sociometric questionnaire at the beginning of the first lesson. It seems

relevant to us to carry out the administration of the questionnaire before the establishment of the collective games. Indeed, insofar as games are a social support conducive to the development of interpersonal relationships (Parlebas, 1999), it seems important to us to carry out a preliminary mapping of socio-affective relationships. This ensures the stability of the data in order to see how socio-affectivity influences the empathic mechanisms involved.

This sociometric questionnaire allows "both metric and clinical study of affective relationships and relationships of influence within groups or communities" (Parlebas, 1992, p. 22). It offers the opportunity to bring out socio-affective relationships within a group. In order to bring out these relationships, it is necessary to be attentive to the assessment criterion used for the 4 questions constituting the sociometric questionnaire (choices, rejections, expectations of choices and rejections). Indeed, if the assessment criterion is functional or instrumental, it is possible that respondents choose partners because of their skills in the activity concerned, and not because they like them. In our case, we ask the students who they would like to be with, but also not to be with, with a view to a discovery stage in Outdoor Physical Activities taking place at the end of the academic year. In this case, these are non-competitive activities only. This criterion makes it possible to obtain responses of great sincerity and to construct a map of affinity relations within the group (Parlebas, 1992). So we asked each individual to tell us who they would like to be with (choice), but also not to be with (rejections), in view of a situation of intense affective communication in the future. Beyond choices and rejections, the sociometric questionnaire also makes it possible to take an interest in the expectations of choices and rejections (Courchet and Maucorps, 1966; Parlebas, 1992; Oboeuf and Besombes, 2016). In other words, we also ask each student to give us the names of those who, in their opinion, will choose or reject them. These expectations will make it possible to operationalize the calculation of a socio-affective empathy index. Our interest is therefore focused on an index of self-empathy, which is the prediction of the designations of others in regard of oneself. It is a question of knowing to what extent each individual is aware of the choices and rejections of which he himself is the object. It is by comparing the perceptions of choices and rejections of each individual with the choices and rejections actually received that we obtain this index of empathy evolving between 0 and 1. We guess that the person who anticipated all the choices and rejections formulated towards him will be said to be empathetic ($n = 1$), while the one who struggles in this exercise will be said to be not very empathetic ($n = 0$).

Parlebas (1992) distinguishes two sub-indices, the average of which gives the empathy index: (1) Relational sensitivity: for each individual, it is the ratio between the number of perceptions that are exact (e) emitted by the subject (i.e., having been confirmed) and the total number of designations and rejections received (d) by the subject ($s = e / d$). This index varies between 0 and 1, s being maximum when $e = d$, i.e., when the subject has perceived all of the choices and rejections of others towards him and (2) Perceptual realism: for each individual, it is the ratio between the number of perceptions of the subject which are exact (e) and the total number of expectations of choices or rejections (a) that he has formulated ($r = e / a$). This index also varies between 0 and 1, r being maximum when $e = a$, that means when a subject will have had, for example, 4 perceptions of exact choices and rejections, and that he will have had no expectation not confirmed. Concretely, if a person has a relational sensitivity equal to 0.9 and a perceptual realism equal to 0.7, we obtain the average socio-affective empathy index (SAEMP) as follows: $(0.9 + 0.7) / 2 = 0.8$. With an index of 0.8, the respondent has a good empathy. Once this work is done, we can, for each group, classify all of our students from the most empathetic to the least empathetic at the socio-affective level. These rankings can then be related to the three indicators of motor creativity and to the rankings obtained for instrumental empathy.

4. Data quality

To determine the data quality (Márquéz Jiménez and Martínez de Santos, 2014), inter-observer reliability and validity tests were carried out. Once the observers had uploaded the video to the Lince program, they started to record the praxical communications, separately. To calculate the praxical fluidity and the praxical flexibility, as soon as the observer spots a praxeme or a direct communication from the player, he presses the corresponding button to record the information. Secondly, to calculate the index of instrumental empathy, he will identify the sub-roles updated by the participants ("Dribbler," "Recoverer" and "Interceptor" in handball; "Shooter" and "Dodger" in Sitting ball) but also success or failure in the attempt (for dribbling, shooting and dodging). The Pearson and Spearman correlation coefficient were used. The values reached always exceeded values of 0.97, thus indicating a high correlation in inter-observer measurements. To assess convergence, for each player, two independent raters (trained) judged the overall performance. They were not informed about the objectives of the work carried out. The inter-judge reliability coefficient were above the critical limit of 0.80. Indeed, the inter-judge correlation coefficients were all above 0.95.

5. Variables

Three dependent variables are associated with creativity: praxical fluency, praxical flexibility and praxical convergence. Fluency (FLU) was defined as the sum of all direct and indirect communications used by a player. Flexibility (FLEX) represents the diversity of communications actualized by the player, independently of the number of occurrences. Convergence (CONV) corresponds to the average score assigned by the experts when evaluating the overall performance of each participant. Then there are two other dependent variables: the socio-affective empathy index and the instrumental empathy index. Socio-affective empathy (SAEMP) represents the ability of the participants to guess the choices and affective rejections of others participants. Instrumental empathy (IEMP) represents the ability of players to anticipate the motor behaviors of participants *in situ*.

6. Data analysis

Therefore, we obtained 5 dependent variables (FLU, FLEX, CONV, SAEMP and IEMP) with two factors: type of activity (HB or SB) and group membership (G1 or G2). These are our 2 independent variables. First, we studied the differences between our two groups using a Mann-Witney test. Then, Pearsons correlation tests were performed between our 5 dependent variables. Finally, in order to investigate more precisely what could be the relationships between the sociomotor empathy and the motor creativity we carried out two different factor

analysis separately for the two activities. The significance level was set at 0.05. On this basis, we distinguish in our results different levels of significance: $p < 0.05$, $p < 0.01$ and $p < 0.001$.

7. The data repository

The data repository is saved in open csv format on the *research.data.gouv.fr*. site at the following DOI location: https://doi.org/10.57745/1C8TIM. This repository consists of 11 columns and 46 lines. The results of each student are presented line by line (lines 2 to 46) according to the indicators of creativity (fluidity, flexibility and convergence) and empathy (instrumental and socio-affective) presented in column (column B to E for the Sitting ball and F to I for handball). The result of socio-affective empathy for each student, obtained through the sociometric questionnaire, is in column J. Remember that fluidity (indicator of praxical divergence) represents, for one collective game, the number of praxical communications realized by each player (60 min per game). This result evolves between 33 and 432 communications in Sitting ball and between 76 and 611 communications in handball. Flexibility (indicator of praxical divergence) represents the diversity of communications used by each player. This result evolves between 4 and 10 communications (out of 13 possible) in Sitting ball and between 5 and 16 communications (out of 20 possible) in handball. The results of praxical convergence evolve between 1 (little creative) and 10 (very creative). This rating is awarded for each game by trained judges based on the overall creative performance of the player. Then, there are two indices of empathy. The first is instrumental empathy and is associated with the player's ability to guess the choices of partners and opponents in a game situation. This result always evolves between 0 and 1 because it is a ratio between the number of anticipations attempted and the number of successful anticipations. It is minimum when the player succeeds in none of his motor anticipations (0) and maximum when he succeeds in all of them (1). The second corresponds to the socio-affective empathy index which also varies between 0 and 1. It is calculated from, on the one hand, the average of the ratio between the number of perceptions of choice and confirmed rejections and the choices and rejections actually received (relational sensitivity), and on the other hand, the relationship between the number of perceptions of choices and rejections confirmed and the perceptions of choices and rejections made (perceptual realism). No other processing was performed on the data before analysis.

8. Materials

Judges recorded the direct, indirect communications and sociomotors sub-roles with the Lince software (Gabín et al., 2012) and the JASP statistical software[1] was used for statistical computation and analysis.

9. Results

9.1. The sample

Two groups of, respectively, 22 and 23 students participated in two collective games (handball and Sitting ball). First, we compared the mean of all the measures between the two groups to search for significative differences between them. Since the conditions for applying a t-test were not always fulfilled, we used Mann-Witney tests for the comparisons. None of the comparisons exhibited a significant difference. Consequently, we considered all the participants as a unique sample in the subsequent analyses.

9.2. Empathy and creativity measures

We then studied separately the relationship between empathy and creativity measures for the two collective games. Considering the Sitting ball activity, we did not find any correlation between the empathy measures (instrumental empathy and socio-affective empathy) and the creativity measures (praxical convergence, praxical fluidity and praxical flexibility). On the other hand, there was a significant correlation between the 3 indicators of creativity (Table 1): fluidity and flexibility ($p < 0.001$), fluidity and convergence ($p < 0.001$) but also flexibility and convergence ($p < 0.001$). The players who make the most communications were also those who diversify them the most. In addition, they were also those whose performances were considered most creative. Another interesting result is that there was a significant correlation ($p < 0.001$) between the two forms of empathy (Table 2). It seems that the players who best guess the feelings of others towards them (socio-affective empathy) were also those who best guess their behavior in the game situation (instrumental empathy).

For handball, as for Sitting ball, there was a correlation between the three indicators of creativity (Table 2). Fluency was correlated with flexibility ($p < 0.001$), fluency with convergence ($p < 0.001$) and flexibility with convergence ($p < 0.001$). The results were not completely the same as for the handball activity since we found that the instrumental empathy was correlated with the three creativity measures (see Table 2). In other words, the more creative the players were (quantity, diversity and quality of performance), the more they managed to accurately anticipate the behavior of other players during the course of the game. Another result was the significant negative correlation between socio-affective empathy and instrumental empathy ($p < 0.05$). In other words, in handball, the participants who best guessed the behavior of others are those who present the lowest levels of socio-affective empathy.

To investigate more precisely what could be the relationships between empathies and creativity indexes we carried out two different

TABLE 1 Pearson's correlation test applied to the dependent variables for the game of Sitting ball.

	Pearson's r	*p*
FLU SB – FLEX SB	**0.655*** **	***p* < 0.001**
FLU SB – CONV SB	**0.760*** **	***p* < 0.001**
FLU SB – IEMP SB	−0.016	0.915
FLU SB – SAEMP	−0.190	0.210
FLEX SB –CONV SB	**0.678*** **	***p* < 0.001**
FLEX SB – IEMP SB	0.060	0.694
FLEX SB – SAEMP	−0.107	0.485
CONV SB – IEMP SB	−0.159	0.296
CONV SB – SAEMP	−0.193	0.203
IEMP SB – SAEMP	**0.594*** **	***p* < 0.001**

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. The significant results are put in bold.

TABLE 2 Pearson's correlation test applied to the dependent variables for the game of handball.

	Pearson's r	*p*
FLU HB – FLEX HB	**0.619*** **	***p* < 0.001**
FLU HB – CONV HB	**0.601*** **	***p* < 0.001**
FLU HB – IEMP HB	**0.673*** **	***p* < 0.001**
FLU HB – SAEMP	−0.091	0.551
FLEX HB – CONV HB	**0.796*** **	***p* < 0.001**
FLEX HB – IEMP HB	**0.320***	***p* < 0.05**
FLEX HB – SAEMP	−0.008	0.956
CONV HB – IEMP HB	**0.301***	***p* < 0.05**
CONV HB – SAEMP	−0.140	0.358
IEMP HB - SAEMP	**−0.331***	***p* < 0.05**

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. The significant results are put in bold.

TABLE 3 Factors analysis for the Sitting ball (left column) and the handball (right column).

	Sitting ball		Handball	
	Factor 1	Factor 2	Factor 1	Factor 2
Convergence	0.864		0.877	
Flexibility	0.787		0.981	
Fluidity	0.860		0.560	
Instrumental empathy (IEMP)		1.015		0.993
Socio-affective empathy (SAEMP)		0.591		X

factor analyses separately for the two activities. This factor analyses were done to search for independent dimensions in the variability of measures. The method used was the parallel method with oblique rotation (promax). The obtained factors were slightly different for the two activities (Table 3).

The factor analyses revealed two factors in both analyses. Considering the Sitting ball activity, empathy and creativity measures were separated in two factors. However, for the handball activity, only the instrumental empathy was represented in the model. The socio-affective empathy did not contribute significantly to any of the two dimensions.

10. Discussion

10.1. A strong footprint of the internal logic on the type of empathy mobilized

Complex cognitive and affective mechanisms are activated in collective games (Parlebas, 1999; Rasmussen et al., 2019). The presence of co-participants forces each player to interpret constantly renewed waves of direct and indirect communications to make their motor decisions. These decisions taken *in situ* are not the result of chance. They are based on subtle empathetic processes, i.e., on the player's ability to guess the behaviors, thoughts and feelings of the other, of others (Berthoz and Jorland, 2004; Stanger et al., 2016). We formulated the hypothesis that to better understand the empathic mechanisms involved, it was necessary to consider the internal logic. For each game, the internal logic defines an interactional, spatial, temporal and material context that guides the ways in which players interact. According to the internal logic, the type of empathy mobilized would be distinct, with a more or less strong prevalence of cognitive or affective factors. In order to verify this postulate, indicators of empathy have been constructed, tested and validated by repeated observations.

For Sitting ball and handball, our trained observers were able to quantify and assess, for each player, his ability to anticipate the behavior of other players, i.e., his instrumental empathy (Oboeuf et al.; Oboeuf and Besombes, 2016). Thus, the Sitting ball player who succeeds in all of his shots and who manages to dodge all of the shots against him shows significant instrumental empathy. This is also the case, beyond technical considerations, of the handball player who succeeds in all his dribbles, the interceptions he tries and who recovers many balls. Our results revealed an interesting phenomenon. In the Sitting ball game, there was a significant positive correlation between instrumental empathy and socio-affective empathy ($p < 0.001$). Conversely, there was a significant negative correlation between these two forms of empathy in handball ($p < 0.05$). Concretely, in Sitting ball, knowing the feelings of others towards him seems to help the player to predict the behavior of the other participants. Socio-affective empathy is a facilitating factor. In handball, it could be a limiting factor. This is related to the fact that the internal logic of handball is binding at the relational level. Relations between players are said to be exclusive and stable (Parlebas, 1992; Oboeuf et al., 2020). Exclusive, because at some point, I cannot choose my partners and my opponents. Stable, because I cannot change partners and opponents during the game. To these constraints adds another determining characteristic: the competitive stake associated with the presence of a scoring system. In team sports, what counts is what counts (Parlebas, 1999). This is the reason why players are massively focused on decoding significant bodily indexes and mobilize the instrumental empathy (valuing cognitive aspects). The competitive stake of handball is opposed by the deeply relational stake of the game of Sitting ball. Its internal logic accentuates the freedom of the player. It is a playful reproduction of relational possibilities associated with our daily lives (Oboeuf et al., 2010). Relationships are said to be ambivalent and unstable. Ambivalent, because we can choose our partners and opponents at any given time according to our desires (pass or shot). Unstable, because you can change partners and opponents or the course of the game (shoot then pass or pass then shoot). The absence of a competitive stake reinforces the socio-affective hue of the Sitting ball.

If in team sports, the stake supplants the game, this does not seem to be the case with the game of Sitting ball. What are the consequences of these observations on the mechanisms of motor creativity activated in these two games? How does the socio-affective empathic coloration of Sitting ball influence the creativity of players? And the rather instrumental empathy of handball?

10.2. Contribution of sociomotor empathy to creativity process

Generally speaking, there are few studies on the articulation of empathy and creativity (Jihyun et al., 2020). Research on games

and sports is no exception to this finding (Parlebas, 1999; Oboeuf et al., 2022). This is the reason why we proposed to compare indicators of motor creativity in an ecological situation (Oboeuf et al., 2020) with indicators of sociomotor empathy themselves linked to the game situation (Oboeuf et al., 2010). The results reveal major differences between the two studied collective games. In handball, there is a correlation between instrumental empathy and the three indicators of creativity: praxical fluidity ($p < 0.001$), praxical flexibility ($p < 0.05$) and praxical convergence ($p < 0.05$). The players who realize a lot of communications (fluidity) and diversify them the most (flexibility) are the participants with the highest instrumental empathy indexes. They are also those whose overall performance was assessed the most creative by expert judges (convergence). Even if these results cannot be generalized, they underline the strong interdependence that is woven between empathy and creativity in team sports. The more creative the players are (quantity, diversity and player match quality), the more they manage to accurately anticipate the behavior of other players.

Previously discussed, the internal logic of handball explains this result. In this environment of high social uncertainty, it is necessary to anticipate and pre-act by wisely decoding the behavior of co-participants (Martínez de Santos, 2007; Ghannouchi et al., 2019). Instrumental empathy is the key to creativity. As Winkin suggests, "if the observer has grasped the interactional system that governs the game of the participants, he can foresee the movements moments before their actual occurrence" (Winkin, 2001, p. 120). It is this time in advance that allows the player to put his opponents in difficulty. It is this time in advance that lets him to express his motor creativity. In Sitting ball, as in handball, the three creativity indicators are correlated. Fluid players are the most flexible and are also those realized the best performances ($p < 0.001$). These results corroborate those obtained in the literature (Lubart et al., 2015; Weiss and Wilhelm, 2022). However, unlike handball, there is no positive correlation between the three indicators of creativity and instrumental empathy. To make their motor decisions, the players also rely on the feelings they ascribe to the other co-participants rather than exclusively on the behaviors they mobilize. This is why instrumental empathy is correlated with socio-affective empathy ($p < 0.001$). This does not mean that the links between empathy and creativity are non-existent in this game. But the internal logic and the freedom it offers to the players undoubtedly involve the joint mobilization of social creativity (Van Bezouw et al., 2021) and motor creativity. It could be interesting to compare the results of social creativity tests (Lebuda and Glăveanu, 2019) with the empathy indicators constructed in this study. If the co-activation of the two empathic mechanisms is obvious, one however notes a more or less strong prevalence of one of the two mechanisms according to the endogenous logic of the activity.

Among the limitations of the study, it should be mentioned that the number of participants ($n = 45$) could have been larger. It would be interesting to carry out the same study with more groups and/or populations of different ages to see if the obtained results are weakened or confirmed. The influence, at a given age, of the level of physical, cognitive and affective development of participants can play a major role in the obtained results. It could also be interesting to question the influence of the internal logics of Sitting ball and handball on the development of socio-affective empathy. With this in mind, a sociometric post-test should be carried out to see: (1) whether these practices influence the evolution of this form of empathy and (2) which of these two games contributes the most to its development. Then, as we suggested, it would without a doubt be relevant to compare other forms of creativity (social, verbal, graphic, etc.) with the sociomotor empathy studied indicators. Each game, according to its internal logic, undoubtedly offers participants the opportunity to express one part or another of their creative potential. Finally, to better define the mechanisms involved in the strategic choices made *in situ*, we could conduct self-confrontation interviews with the players (Martinent et al., 2015). Such interviews could provide interesting elements to pedagogically support the development of sociomotor empathy and motor creativity.

10.3. Conclusion: empathy at the service of adaptability

Everyone reads the world through the window of their experiences. As such, the human brain can be described as projective, meaning "it projects its rules of analysis, its preperceptions onto the world, it is a generator of hypotheses" (Berthoz and Jorland, 2004, p. 257). At our level, these finding questions the motor experiences that students must face in Physical and Sport Education. What motor adventures should be favored to participate in the construction of a more "empathetic" world, potentially favorable to living better together? Should team sports be valued exclusively? On the other hand, should we offer traditional games with more flexible interactional modalities? Resolutely, our opinion is that it is necessary to diversify the reading proposed grids. Empathy is more than understanding other people's feelings or anticipating their behaviors (Courchet and Maucorps, 1966; Decety and Ickes, 2009). Empathy in handball is mainly based on the decoding of significant bodily indexes, while in Sitting ball the feelings that we attribute to others take a major place. Empathic acuity, its deployment and development are jointly based on affective and cognitive factors. Empathy is a subtle blend of these two types of resources. To swap one's "egocentric" frame of reference for an "allocentric" frame of reference (Berthoz and Jorland, 2004; Gauthier and Berthoz, 2019), it is therefore necessary to go through a diversity of motor experiences. We can think that the more they diversify, the more we broaden the spectrum of our reading grids… and the more we adapt to the random flow of our social interactions with accuracy.

In this regard, it is undoubtedly crucial not to overvalue the cognitive aspects to the detriment of the affective aspects. The empathy must not be sclerotic, trapped in the pursuit of strictly rational and selfish purposes. It allows also to open a breach where the affective aspects can rush in order to reveal that "true altruism is not always reduced to a form of disguised selfishness" (Ricard, 2013, p. 14).

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the ethics committee of Paris Descartes University (France). The patients/participants provided their written informed consent to participate in this study.

Author contributions

AO, SH, EF, and JB have contributed to the theoretical and methodological development of the manuscript, and prepared the results and discussion. SH, SC, and LL have contributed with the data analysis. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Identification and description of the sociomotor sub-roles and the Ludogram of Brazilian jiu-jitsu

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Introduction: Brazilian jiu-jitsu (BJJ) was conceived to be an oppositional sociomotor practice with an emphasis on self-defense, but throughout the 20th century, BJJ gained sporting features, modifying its internal logic (IL). In BJJ, the richness of the motor itineraries can be revealed in the different sociomotor sub-roles. Considering the absence of research that identifies and describes the sub-roles and the Ludogram of BJJ, the following question was asked: how can the Ludogram of sociomotor sub-roles of Brazilian jiu-jitsu be systematized in accordance with its internal logic?
Methods: This work is characterized as theoretical research that is dedicated to rebuilding theories and concepts with a view, in immediate terms, to improving theoretical foundations. In this study, a theoretical reconstruction of BJJ's operating dynamics was carried out, identifying roles and sub-roles, culminating in the construction of a Ludogram. The praxeological analysis was divided in two stages: (1) Description of the BJJ sub-roles based on sports rules and video analysis; (2) Systematization of the BJJ Ludogram. Eight public videos with unrestricted access were selected of fights from the 2018 BJJ World Championship. The sample was considered based on the following criteria: convenience, typicality, and saturation.
Results and Discussion: The 26 identified and described sub-roles of BJJ indicate the richness of choices and possible paths to be followed by fighters within this itinerary of motor interaction. These different BJJ sub-roles described in this research highlight the importance of the concept of praxis communication, specifically, motor counter-communication, since many of the dynamics between a fighter's subroles refer to the choices that the opponent indicates for the motor dialogue. BJJ requires from fighters incessant activations on aspects related to sociomotor intelligence, such as the need for sociomotor empathy, motor strategy, to anticipate anticipations, pre-acting, developing the capacity to make motor decisions, to recognize the affective, cognitive, relational, and organic loads activated during the fight, and to develop their motor conduct. In this sense, the Ludogram was elaborated, which enables future praxeological analyses of the sub-roles and motor conducts of any subject who wants to assume the sociomotor role of a BJJ fighter according to the rules of this Brazilian combat sport.

KEYWORDS

motor praxeology, Brazilian jiu-jitsu, internal logic, sociomotor sub-roles, Ludogram

1. Introduction

The theme of internal logic (IL) from motor praxeology (MP) refers to a process of dense, systematic, and scientific description of elements that reveal the central/nuclear, structuring, and systemic aspects of a motor practice. MP has often been compared with music theory, in particular, with the musical notation process that consists of structuring/systematizing a musical work into scores. But the score of a song does not manifest itself. It needs a protagonist, the performer, the musician, to bring it to life. And a good musician goes back and forth from the score to interpretation and from interpretation to the score as many times as necessary to reach a synthesis of that work.

In the field of physical education, before Parlebas' proposal, there was no possibility of basing its pedagogical practice on a grammar of motor practices. The pedagogical practice, which is dedicated to the teaching-learning process of sports games, as well as the reflection on the same, was, and still is, guided by apparent elements of motor practices, with pedagogical objectives that do not value the subject who moves inside the game. The emphasis is only on movement, with techniques isolated from the game system, without understanding the meaning of such actions, whether directly related to internal logic or related to aspects of external logic (such as history, social context, pedagogical objectives, culture).

Concerning the aspects of the external logic of BJJ, according to Gracie (1), historically it is recognized that forms of jiu-jitsu were already practiced in the mountains of India for at least 2,500 years, later spreading through China about 400 years ago, and further strengthened as a fighting art in Japan. Only in the 20th century did Japanese jiu-jitsu culture reach South America. According to Lise and Capraro (2), the arrival of jiu-jitsu in Brazil was initially due to the arrival of two Japanese fighters, Sada Miyako and M. Kakiora, whose role was to teach the techniques of this martial art to Brazilian sailors in 1908 even before it became known to the Brazilian population. It should be noted that this version is opposed to the hegemonic story reported by Gracie (3), which argues that Mitsuyo Esai Maeda, also known as "Konde Koma", would be responsible for the arrival of jiu-jitsu in Brazil, in Belém do Pará in 1915. According to Lise and Capraro (2), Miyako's arrival in Brazil occurred approximately six years before the arrival of Konde Koma, who would have landed in Brazil in 1914 and not in 1915 as mentioned (3).

However, the history of this combat sport in Brazil is sometimes confused with the history of the Gracie family. According to Gracie's historical version, Gastão Gracie became a jiu-jitsu enthusiast and took his eldest son, Carlos, to learn from Konde Koma. From that moment on, a whole dynasty of brothers, grandchildren, and great-grandchildren would practice and develop this combat sport, spreading it throughout Brazil and, more recently, to the world (3). In the 20th century, the jiu-jitsu practiced by the Gracie family began to present ground submission techniques that were more sophisticated than traditional Japanese jiu-jitsu (1). Changes and technical adaptations related to practice have altered the complexity of jiu-jitsu principles, making it even more efficient as a self-defense system (4). In this sense, according to Lise and Capraro (2), the importance of Konde Koma in the process of disseminating jiu-jitsu in Brazil is undeniable, as is the importance of the surname Gracie for the worldwide recognition of jiu-jitsu. In addition to the emphasis on self-defense, BJJ is currently organized as a sport, with the International Brazilian Jiu-Jitsu Federation (IBJJF) as the main institution that organizes the rules and championships of this Brazilian fighting modality worldwide.

Regarding the general aspects of the internal logic of BJJ, a preliminary study carried out by Schmidt and Ribas (5) revealed that, according to praxeological analyses, this corporal fighting style, conceived as a praxeological system, is characterized as: a sociomotor practice of opposition; unrolled in a stable environment; a duel between two individuals situated at almost null guard distance, with motor interactions directed at the opponent's body (joint locks, strangulations, falls, projections, imbalances, immobilizations, etc.); in addition, both participants assume the same sociomotor role, that is, they have the same rights, obligations, and restrictions regarding motor interactions.

BJJ has direct praxis communication of motive counter-communication and indirect praxis communication, through praxemas and gestures. But, due to the fact that the responsibility for victory or defeat always falls to one of the participating fighters, BJJ has been mistakenly conceived as a motor practice of individual action. However, characterizing it as a psychomotor or individual action sport refers to organizing didactic situations in an internal logic different from their needs for direct and indirect practical communication (5). The authors conclude that motor counter-communication interactions require participants to develop the competence to read and interpret the opponent's body messages. At the same time, fighters must make their interpretations difficult, seeking to confuse their real intentions so that they are not decoded by the opponent, which determines complex motor behaviors of strategy and motor decision.

The characterization of these aspects of IL becomes essential to guide the teacher-coach's pedagogical practice. Ribas (6) pointed out that this new knowledge contributes to a better understanding of the elements of motor practice, in addition to teaching with more consistency and meaning. The aforementioned author also pointed out that the concepts of IL must be shared, constructed, and appropriated by student-athletes as well. Parlebas (7) added that the objectives and pedagogical effects of a pedagogical practice are closely related to the IL of the practice, as they refer, at a first level, to the very improvement of the motor practice by the learning subjects, as well as to the development of the participant's personality through their motor behavior.

Still in relation to the pedagogical aspects, it is highlighted that the IL should not be a determinant of the motor behavior; it is not a path that goes only in this direction. It is understood that this relationship must work in both directions, and may even cause the pedagogy of motor behaviors to transform elements of IL. Parlebas (7) reinforced this relationship in the following statement: "… *the internal logic of a motor practice can be*

reinterpreted from the outside, by an "external" logic that attributes new and unusual symbolic meanings to it (p. 307)".

In the case of BJJ, IL should not be placed on a pedestal as the ultimate goal. Along the way, it is possible that other possibilities for practicing Brazilian jiu-jitsu will arise, with simpler, safer rules and, above all, adequate to the pedagogical needs of the teacher-coach. That is, a permanent Üycle of consideration of the internal logic and its relationship with the motor behavior and returning to the pedagogical practice and its objectives.

Considering the pedagogical aspects, Schmidt and Ribas (5) defended the need for further praxeological studies of BJJ to unveil its praxeological system. The production of this scientific knowledge is sought to overcome the superficial understanding regarding the structures and dynamics of motor practices. MP instrumentalizes scientists and teachers to develop their studies and pedagogical practices in order to understand the internal logic relationships—motor conducts.

In practices with only one sociomotor role, as in the case of BJJ, the richness of the motor itineraries which the participating fighters can go through will appear at a second level of analysis, in the socio-motor sub-roles, which, according to Parlebas (7), are dependent on the sociomotor status and its dynamic translation of sociomotor roles. A sociomotor sub-role is defined as the "…ludomotor sequence of a player considered as the basic behavioral unit of the strategic functioning of a sports game." (7).

Sub-roles refers to a type of motor behavior that groups actions considered strategically equivalent. Parlebas (7) elucidated by exemplifying that "the multiple ways that a player has to pass the ball to a teammate (with one hand, with both hands, standing, running, with the arm bent, turning around, etc.) will be grouped in the same sub-role that we label as 'pass'." Parlebas (8) demonstrated that in the case of field football, the role of the field player can be subdivided into sub-roles such as: passer, finisher, dribbler, recoverer, etc.

The catalog of sociomotor sub-roles of a sports game is not enough to know its functioning mechanisms. One must discover the syntaxes that combine these units, that is, the network of possible linkages, dynamics, exchanges, and inversions of sub-roles. A succession of sub-roles constitutes a summary of a player's motor behavior when expressing his choices, preferences, and motor decisions, that is, aspects related to motor behavior and its intimate relationship with the internal logic of the sports game (7).

Sociomotor sub-roles represent the matrices in which all the potential sequences that can be updated by the players are pre-programmed, invariant networks that authorize an infinity of variations, a trajectory that can be drawn in the form of a Ludogram (7). According to Parlebas (7) the Ludogram is the "… graphical representation of the sequence of the sociomotor sub-roles (and possibly of the sociomotor roles) assumed by a player successively during the development of a sports game". the Ludogram is an instrument for studies referring to the player's motor strategies, as well as to understand the relational, motor decisions, and organic and affective aspects of a participant, that is, his motor behavior (7).

Thus, with the aim of creating scientific parameters for combined analyses of the internal logic-motor conduct relationship of BJJ, the research problem arises: how can the Ludogram of sociomotor sub-roles of Brazilian jiu-jitsu be systematized in accordance with its internal logic?

2. Materials and methods

This work is characterized as theoretical research that, according to Demo (9), is "*dedicated to reconstructing theories, concepts, ideas, ideologies, polemics, with a view, in immediate terms, to improving theoretical foundations*". In this study, a theoretical reconstruction of BJJ's operating dynamics was carried out, identifying roles and sub-roles, culminating in the construction of a Ludogram, a process called praxeological analysis.

As for the scope of the research (level of explanation), the study is characterized as being exploratory and descriptive. Exploratory studies serve to make a relatively unknown phenomena familiar; to obtain information about the possibility of carrying out a more complete search related to a particular context; research new problems; identify promising concepts or variables; and establish priorities for future research or suggest assertions and postulates. Regarding the descriptive scope, the objective was to describe phenomena, situations, contexts, and events; that is, detailing how they are and how they manifest themselves, seeking to specify the properties, characteristics, and profiles of a phenomenon that is submitted to analysis (10). In this research, such a description refers to a praxeological analysis that consists of articulating the concepts and tools of MP with the aim of revealing the internal logic of BJJ to structure and systematize the BJJ Ludogram.

With regard to the praxeological analysis, BJJ's operating logic was described from the relationship between: MP concepts and tools; the official rules of the modality found on the website www.cbjj.com.br; and the observation of motor behaviors through a non-participant systematic observational analysis of BJJ fight videos. This procedure made it possible to map the motor situations of BJJ to facilitate its understanding, a technique known as modeling (11). From this perspective, reality is represented in the form of models of praxeological analysis and follows some dimensions of interpretations and different methodological guidelines including, among these elements, the universals of sports and games (7).

2.1. Methodological strategy for analyzing BJJ's internal logic

The tools and concepts of MP were the instruments used to interpret the characteristics of the internal logic. For the praxeological analysis of the internal logic of BJJ, five of the seven universals of sports and games were used, which represent the basic operating structures of the internal logic of motor practices (7). This article presents, specifically, the results of the identification and description of the BJJ sociomotor sub-roles with the aim of systematizing the BJJ Ludogram.

In addition to the information present in the IBJJF rulebook, it was necessary to complement this analysis by observing the motor behavior of fighters who participate in international competitions. According to Parlebas (7, 8), in order to characterize the sociomotor sub-roles, it is necessary to know the rules of the game and take into account its norms, as well as to carefully observe the behaviors developed in the practice space. The observation of motor behaviors was carried out through a systematic, non-participant, observational analysis of videos of BJJ fights, public videos from youtube.com from the IBJJF channel with unrestricted access. The observational analysis of the videos of the fights had the function of contributing to:

- Identification of the sociomotor sub-roles;
- Description of the classes of motor interactions of each sub-role;
- Systematization of the Ludogram.

The five universals of games and sports were articulated with the concepts of the theory of motor action, mainly with the terms indicated at the end of each of the universals present in the Lexicon of Motor Praxeology, which, according to Parlebas (7), are interrelated. This articulation allowed a deductive analysis based on BJJ rules and the observational analysis of the operating models that represent the basic operating structures of the internal logic of BJJ. This methodological systematization is demonstrated in **Table 1**, in which the universal "the graph of changes in sub-roles" stands out for this article.

2.2. Video sample selection

The criteria for choosing the sample of videos included convenience, typicality, and saturation. Convenience, due to the possibility of analyzing the videos of fights from one of the main BJJ events available on the internet with public and unrestricted access: fights from the 2018 Brazilian Jiu-Jitsu World Championship with reference fighters in the modality. Typicality, because, according to Lakatos and Marconi (12), in certain cases, when it is not possible to make a probabilistic sample, sampling by typicality tries to seek a representative sample by other means. One way to do this is to look for a subgroup that is typical of the population as a whole. In this case, it is typical because the internal logic pre-orients the elementary actions of anyone who submits to its rules, which is the specific case of these fights.

Considering that the specific objective is to reveal the representative sociomotor sub-roles of the fight, the total number of samples to be analyzed in relation to the selected videos was not initially defined. Therefore, the sample saturation technique served as a reference to define, during the research, when to interrupt such analyses. From the fifth video, the identification of new BJJ sub-roles was significantly reduced, with this reaching saturation once the eighth video was analyzed. It was decided to carry out the descriptions of the sub-roles of the fighters who participated in the 2018 world championship organized by the IBJJF, that is, who fight by the same rules that are serving to characterize the internal logic of this work.

According to Parlebas (7), for a system of rules given, the number of sociomotor roles is constant, but the same does not occur with the sub-roles, which can vary according to the characteristics of the players, their age, capacity for initiative, and technical and tactical levels. These variables will modify the range of assumed sub-roles. From this perspective, we sought to analyze the motor behaviors of high-level athletes in order to try to identify and recognize as many sub-roles as possible, considering their initiative capabilities and technical and tactical levels. However, the author explains that the sub-roles leave some margin, as they depend on the fighters' decisions to assume them. Therefore, future research may corroborate or advance what has been produced so far regarding the identification and description of BJJ's sociomotor sub-roles.

For reasons of standardization, the videos chosen for analysis were from the black belt category, from the final and semifinal fights of the male and female categories of the same championship, available on the IBJJF channel on the website youtube.com, consulted during the second half of 2019. It was decided not to define a weight category so that the possibilities of minimum strategic actions were as wide as possible, in order to avoid some sub-roles not being characterized, affecting the identification and description of the sub-roles. Therefore, **Table 2** presents the criteria used to choose the analyzed videos:

The sociomotor sub-roles were identified and described over the time of the video of each fight according to the spreadsheet built specifically for this observational analysis, considering the criteria described by the motor action theory. Based on Parlebas (7, 8, 13, 14), **Table 3** shows the concepts that were used as criteria to identify and describe the sociomotor sub-roles of BJJ.

In order to carry out the observations of the videos, spreadsheets were created in which it was possible to describe the motor behaviors and identify the sociomotor sub-roles of BJJ.

TABLE 1 Methodological scheme for analyzing the internal logic.

The Game: Universals of games and sports					
Universals of games and sports	The network of motor interaction	The network of score interaction	The score system	Sociomotor role exchange network	The graph of changes in sub-roles
Concepts and praxeological tools used to describe the internal logic	Motor communication; Motor counter communication; Score interaction; Duel; Graphic	Motor communication; Motor counter communication; Score interaction; Duel; Graphic	Score; Support; Universal; Punctuation; Score interaction	Sociomotor status; Sociomotor role; Universal; Graphic; Internal logic; Sports space; Categories	Sociomotor sub-role; Ludogram; paper network; sociomotor role; Graphic
Search sources	IBJJF Rule book				IBJJF rulebook + BJJ fight videos

TABLE 2 Criteria for selection of fight video samples.

Criteria for selection of fight video samples
• Videos published by the IBJJF channel on youtube.com.
• Videos from the "World championship 2018" playlist.
• From the videos in the "World Championship 2018" playlist, the videos that present the following in the video description will be included: the weight category, belt category of the Uthletes, and phase of the championship that the fight is occurring.
• The fights must be from the finals and semifinals of the 2018 World Championship, male and female black belts, and any weight category.
• Full fight videos (which show the fight from start to finish) and which show the time and score in the fight video.
• Total quantity of videos on the World Championship 2018 Brazilian Jiu-Jitsu playlist: 29 videos. • Total analyzed videos: 8 videos.

TABLE 3 Synthesis of concepts used to identify and describe BJJ's sociomotor sub-roles.

Concepts used as criteria for identifying and description BJJ's sociomotor sub-roles
• Sub-role is the ludomotor sequence of a player considered as a basic behavioral unit for the operation of a sports game.
• It is necessary to know the rules of the game and take into account its norms, as well as carefully observe the behaviors developed on the ground.
• Some minimum strategic units can last for a few minutes and others a few seconds;
• Sub-role refers to types of motor behavior that group actions judged to be equivalent from a strategic point of view.
• The sub-roles will correspond to interactions that lead fighters to take initiatives and motor decisions (which may succeed or fail).
• A sub-role has its own unity both within the player's internal logic and strategic logic.
• A sub-role is constituted as a praxis sequence that can be considered as a minimum unit of tactical interaction of the operative functioning of the sports game.
• The elementary strategic unit is undoubtedly the sub-role, that is, it is what gives meaning to the partial elements whose relationship allows its definition. Every partial element and every indicator can be read as a clue.

TABLE 4 Identification of BJJ sub-roles (model).

Praxeological analysis worksheet of sociomotor sub-rolesidentification and description of the sub-roles of Brazilian jiu-jitsu fighters				Page
Fight:	Stage of fight:		Championship:	
Video link:				
Video time	White Kimono Fighter (WKF)	Blue Kimono Fighter (BKF)	Strategic role	Comments
	Sub-roles	Sub-roles	WKF / BKF	

The spreadsheet also presented general information about the fight (name of the fighters, stage of the fight, championship, and video link), as shown in Table 4.

From the results obtained in the spreadsheet and the deductions made according to the rules of practice, a table was built identifying and characterizing the sociomotor sub-roles with the description of the corresponding motor interaction classes. The results of the study will be presented below.

3. Results and discussion

3.1. Internal logic of Brazilian jiu-jitsu: the sociomotor sub-roles

The identification of the sociomotor sub-roles highlights the structural part that is closest to the interactions of BJJ fighters, while it makes it possible to understand the motor conduct of the participants when unveiling their initiatives and practical choices. Therefore, it allows a combined analysis of the game's objective logic and the player's subjective conduct (7). Lagardera and Lavega (15) contributed by indicating that each sub-role represents a strategic action whose dimension, being basic or minimal, allows a very precise approximation to what happens on the field of play.

Since BJJ only has a sociomotor role, it could indicate that it would not activate different possibilities regarding the motor conducts of its participants. But, in BJJ, this sociomotor role allows the fighter to assume different minimum units of opposition interaction, revealing a potential for activating and developing the motor conducts of the participating fighters.

According to Parlebas (7), the concept of sociomotor sub-roles can illuminate the two inseparable aspects of motor action. On the one hand, it highlights the objective system of essential strategic units necessarily carried out by any player, however original they may be; on the other hand, it manifests the praxis choices made by the individual, indicates the sequences preferred by any participant, and reveals the forms of relational expression proper to each one.

Parlebas (7) points out that every sociomotor sub-role must be labeled by the researcher with a noun that highlights the dominant interaction linked to the observed sequence, which represents an elementary action that must be indicated by a verb. Remember that, in the case of the sociomotor role, it is impossible to have the same clarity because it encompasses a set of different actions. What should be done is to identify the sociomotor role through a label with a broader—and, therefore, more blurred—meaning, which will have a denominative value instead of a descriptive one. In this way, the sociomotor role of BJJ was denominated as "Fighter of Brazilian Jiu-Jitsu". Table 5 below shows the identification and description of the different sociomotor sub-roles of BJJ. As it is a Brazilian combat sport, the names of the sub-roles are also presented in Portuguese.

"*Identifying a new phenomenon and defining it is also acting. It is looking at the land with different eyes. Scientific language is not opposed to technical language: both complement each other. The conquests of physical education will also be those of its language*" (17). Due to the unprecedented nature of the praxiological analysis, all sub-roles were named for the first time. Some names, inevitably, are similar or the same as those spoken in the academies where BJJ is practiced, because they are motor interactions of the practice itself. However, based on the theory

TABLE 5 Identification and description of sociomotor sub-roles in Brazilian jiu-jitsu.

Sociomotor Role: Brazilian jiu-jitsu fighter	
Sociomotor sub-role corresponding motor interaction classes	
ON ALERT *(em alerta)*	This sub-role implies a predisposed, alert, attentive attitude on the part of the fighter, ready to intervene at any moment with the opponent, before the search for a grip on the kimono or other contact with the opponent (body) that aims at some control of fists, hands, neck, etc. The fighter, usually, is in the initial moments of the fight, standing up or after a dispute for a position in which both do not have a grip on the opponent's body or kimono. The fighter is in this sub-role until they seek another driving interaction with the opponent.
GRABBER*(agarrador)*	The fighter tries to interact with the opponent in search of a grip on the kimono or an initial grip on the opponent's body in a way that allows initial control. When the fighter tries to grip with no definition of which motor interaction will occur next. The fighter seeks to gain initial control over the opponent through the grip on the opponent's kimono or a grip on the opponent's body. When the fighter tries to grab to control the hands, wrists, ankles, shins, knees, etc., without subsequent direct interaction. This motor interaction was identified as a sub-role, as it is not possible to deduce another strategic intention of such a grip through the observational analysis of its motor behavior, since in all of them the grip breaks down. It remains in this sub-role until it finally changes its motor behavior. Contrary to this, there are cases in which the fighter takes hold of the kimono and immediately tries to pull the opponent to their guard or even grabs the kimono to try to take down or to try to dominate the back. In these cases, each of these interactions is considered as a separate sub-role, in which the grab of the kimono is a partial element, that is, it is part of a dominant interaction, with another strategic objective, another sub-role. In BJJ, grabbing the opponent's kimono is part of many driving interactions. But in the case of the sub-role that was called "grabber", specifically, what can be observed is the search for the grip on the opponent's kimono or body for an initial domain; the fighter can also be observed changing grips from one collar to another, or from one sleeve to another, or from one pantleg to another, usually with both fighters standing. Whenever this grappling interaction does not evolve immediately into a possible motive interaction of taking down, grabbing the opponent's back, pulling guard, etc., it is characterized as the grabber sub-role.
DODGER*(esquivador)*	The fighter unfolds their body with the intention of not being grabbed by the opponent who seeks to control their kimono or have some control over their fists, hands, arms, or neck. They unfold, and dodge being grabbed by the opponent. Movements of the arms, hands, and legs can be used to avoid the opponent's grip.
FINISHER*(finalizador)*	The fighter seeks to apply a driving interaction that objectively can lead their opponent to submission or giving up (chokes, keys on joints and bones). Attempts to finish the fight before the expected regular time of the fight. If they succeed in submission, the duel ends, declaring them the winner.
SUBMISSION DEFENDER*(defensor de finalização)*	The fighter who suffers a finishing motor interaction, tries to defend themselves preventing the opponent from succeeding in submission, explicitly seeks to escape or defend themselves from the blow. If the fighter is not clearly defending themselves from the blow, they should not be considered as in this sub-role. Giving up gesture: the fighter taps twice with the palm of the hand on the opponent, on the ground, or on themselves, manifestly and visibly giving up the fight; or when the athlete taps their feet twice on the ground when their arms are trapped by the opponent. If they fail to defend themselves from submission and issue a gesture of withdrawal or even a cry of pain, the combat ends, declaring them as defeated.
GRAPPLE BREAKER *(quebrador de pegada)*	This sub-role involves trying to rip off or break the grips the opponent makes on their kimono or some part of their body, seeking to break the grip dominance that the opponent maintains. This sub-role should not be confused with interactional situations in which breaking the grip is part of a sub-role, such as, for example, breaking the grip to try to pass guard, or to attempt a takedown. In this sub-role, strategic intent is restricted to breaking the hold caused by the opponent's grip.
THROWER*(quedador)*	Starting from an initial movement with both feet on the ground, this sub-role seeks to throw the opponent to the ground. This sub-role can be scored (two points) when: "one of the athletes, starting with an initial movement with both feet on the ground, throws the opponent to the ground on their back, sideways, or makes them fall sitting down, keeping the fight on the ground, and stabilizing the position on top for three seconds" (16).
THROW DEFENDER *(defensor de queda)*	The fighter, in a standing fight, tries to balance themselves and lock their body, stabilizing their body in a standing position, in order to avoid being thrown to the ground. Alternatively, when already thrown to the ground, they try to get up again, trying to stay on their feet, avoiding as much as possible attempts by their opponent to control the fight on the ground and receive points for the interaction of taking down, for example.
GUARD PULLER *(puxador de guarda)*	This sub-role intends to pull the opponent into their leg guard in a ground fight. It could be a transitional interaction from standing to ground fighting. Or every time both are already engaged in the fight on the ground and the opponent who is usually on top moves away, causing the fighter to try to grab to get closer to the opponent, pulling them back to their leg guard; after this interaction, the sub-role changes. The fighter in the fight on the ground and underneath seeks to grab the opponent who moves away from their control of the legs to have the opponent under their guard again.
SWEEPER*(Raspador)*	This sub-role can be scored (two points) when: the fighter starting from a leg guard position (closed guard, half guard, open guard) manages to reverse the position, forcing the opponent who was on top to stay on the bottom in the fight on the ground and manages to stabilize that position for three seconds to earn the score (16). A good indication of the beginning of this interaction can be seen every time the sweep manages to unbalance their opponent with the intention of sweeping/reversing the opponent, causing their opponent to manifest a visible motor behavior in defense of the sweep, that is, they force the opponent who is on top stuck in the guard changing their leg positions to rebalance themselves, opening their base with their legs, for example, or fall with the body sideways, trying to defend and come back, not accepting the sweep/inversion by the sweeper. At the end, it is necessary to analyze which driving interaction will occur, always considering the guard relationship between the opponents to define which sub-role will be assumed. If, at the end of the inversion, the opponent turns their back up, on all four supports, and the athlete who started the inversion controls the opponent's back without the need to place the hooks, but keeps the opponent with at least one knee still on the ground, thus it is configured as the end of this interaction. If, during the inversion, the opponent stands up, but the sweeper maintains control of the necessary grips to continue the sweep even if they need to stand up and take the opponent down, it is also considered as a sweeper sub-role. It is noticed that even having used a takedown, its tactical intention refers to the interaction of a sweep, according to the rules of the modality. When both fighters are sitting down doing 50/50 guard (both fighters sitting on the ground with one of their legs intercrossed with the opponent's), the one who tries to get up and stay on top will also be considered as a sweep interaction.

(*Continued*)

TABLE 5 (Continued)

Sociomotor Role: Brazilian jiu-jitsu fighter	
Sociomotor sub-role corresponding motor interaction classes	
GUARD CONTROLLER *(controlador de guarda)*	In a ground fight, the fighter who is on the bottom with the opponent in guard or half-guard or open leg guard tries to prevent the opponent who is on top from crossing their leg guard. The fighter seeks to keep the opponent under their leg guard control and does not demonstrate behavior with the objective of sweeping the opponent according to the sweeper sub-role. This sub-role sometimes presents itself as a behavior of little movement, just control/offside, especially with the legs, on the opponent who is trapped in its guard. Hand grips on the opponent are crucial for this domain, but the dominant interaction comes from controlling the opponent's legs, preventing them from passing their leg guard and interacting directly with their torso.
GUARD PASSER *(passador de guarda)*	The fighter seeks to break through the opponent's leg guard, overcome their guard, and cross the opponent's legs that control them, with the intention of seeking some free domain of the opponent's leg guard; this demonstrates motor behavior that they really want to cross or pass the opponent's legs in search of approaching the opponent's trunk without direct interaction with their legs. This sub-role is subject to scoring (three points): whenever the fighter manages to overcome the opponent's leg guard, controlling the opponent's guard-free trunk and stabilizing in that position for three seconds, the score will be marked.
SWEEP DEFENDER *(defensor de raspagem)*	The fighter demonstrates imbalance and seeks to rebalance, defend, and prevent the sweeping interaction performed by the opponent who is below. Or when both fighters are sitting down doing 50/50 guard, the one who tries to prevent the opponent from going up gets up and stays on top, avoiding the sweep interaction; in this case, it should be considered as in the sweep defender sub-role.
TRUNK CONTROLLER *(controlador do tronco)*	A fighter free from the opponent's leg guard seeks to maintain control of the opponent's torso on the ground; this control can be transverse or longitudinal in relation to the opponent's body. It is trunk control that does not refer to sitting/mounting the opponent's trunk from the front or back, nor to dominating the opponent's back, nor to controlling the trunk using the knee on the belly. This description point deserves an important consideration regarding this sub-role and others referring to different domains on the opponent's torso that the fighter seeks throughout the BJJ fight: whether to subdivide the different domains of the opponent's trunk or not. Would they all be the same sub-role (trunk controller)? After examining in detail the internal logic of BJJ, through its rules and the influence of the scoring system, it was understood that one cannot consider all domains on the trunk as the same sub-role, since one of the characteristics pertinent to the concept of sub-role says respect, first, the influences that lead fighters to take initiatives and motor decisions (which may succeed or fail); second, to characterize a sub-role, it must be considered that it has its own unity both within the internal logic and the strategic logic of the fighter. Therefore, in this case, both definitions of the motor action theory induce the researcher to deduce that it is necessary to subdivide the different domains of the trunk. The scoring system encourages/channels the fighter to make different motor decisions based on this interaction. From this torso control interaction, the fighter will be able to try to sit/mount on the torso from the front, from the back, put the knee on the belly, dominate the opponent from the back, or force the opponent to submit. The interaction itself is already different (sitting down, placing a knee, controlling the back), as such interactions are worth points, leading the fighter to take initiative and make motor decisions. In addition, the rule punishes the fighter who is controlling the opponent's torso in this situation for more than 20 s, forcing them to look for other sub-roles. This understanding of the sub-role concept that leads the fighter to make different motor decisions and seek other domains will also weigh in the characterization sequence to define the different escapes of each of these domains, since the fighter who suffers the interaction of each one of these sub-roles should not accept such an interaction, as it will reflect on the score, leading them to decide strategically and seek initiative again by not accepting, therefore, that the different domain interactions take place.
FRONT TRUNK MOUNTER*(montador do tronco de frente)*	The fighter who tries to sit on the trunk of the opponent who is facing them. The criterion for dividing the sub-roles took into account the scoring system, as it leads the fighter to make decisions. The rules allow points to be accumulated by going from a front mount directly to a back mount. This sub-role can be scored (four points) when: the athlete who is on top and already free of the leg guard sits on the opponent's torso facing forward and keeps both knees or one foot and one knee on the ground, facing the opponent's head and with up to one arm of the opponent trapped under their legs, keeping it that way for three seconds (16).
BACK DOMINATOR *(dominador das costas)*	The fighter who seeks to dominate the opponent's back (control/immobilize the opponent from the back). Situations in which the fighter already has their opponent on their back and seeks to evolve to control and dominate their opponent even more through grips and dominance of the back. It appears in all situations in which the fighter is faced with the opponent's back to them at the same time that they seek to evolve in that domain of the opponent's back. This is a scoring sub-role (four points) when: the athlete dominates the opponent's back, placing the heels on the inner part of the opponent's thighs, without crossing the feet, and being able to imprison even one of the opponent's arms without the leg that imprisons the arm passing the shoulder line, and keeping it under control for three seconds (16).
GUARD RECOVERY PREVENTER *(impedidor da reposição de guarda)*	The fighter, after losing some free control of the opponent's leg guard (back control, front and back mount, placing knee on belly, lateral trunk control), demonstrates motor behavior of not accepting/preventing the opponent's guard replacement, defends the replacement to stay free of the guard. It is not possible to identify which domain will do, what is predominantly observed is the attempt to prevent the replacement of guard that the opponent tries to do. An important detail: in the guard-passing sub-role, a similar situation happens; however, the dominant interaction is passing the guard and then seeking some control. The final phase of the pass also appears something like preventing the replacement, but in the case of the pass it is the final phase of the interaction, that is, they are still in the sub-role of passing guard until there is some dominance over the opponent free of guard. Therefore, the replacement impeding sub-role is a transitional position of the fighter who had control over the torso but the opponent has already defended themselves against these controls, freeing themselves to try to replace the guard. The fighter who prevents the replacement, tries to look for some free domain of the guard, when they demonstrate observable behavior of one of these domains, they change the sub-role.
ESCAPER FROM THE DOMAIN OF THE BACK*(escapador do domínio das costas)*	The fighter tries to avoid, to defend, or to get out of the opponent's back grip (remove the hooks, rotate the torso, escape/displace the hip). This sometimes presents itself under strong immobilization or little movement.
	The fighter, in an attempt to prevent the opponent from mounting their trunk from the front, or when already mounted, defends themselves by pushing the opponent's legs, unbalancing the opponent in an attempt to escape.

(*Continued*)

TABLE 5 (Continued)

Sociomotor Role: Brazilian jiu-jitsu fighter	
Sociomotor sub-role	**corresponding motor interaction classes**
FRONT-MOUNTED ESCAPER*(escapador da montada de frente)*	This sub-role sometimes uses hip strength, pushing the opponent upwards, trying to move away from the opponent to find some space. The fighter looks for some grip on the opponent's body that gives them the minimal control to perform an exit from that control. This sometimes presents itself under strong immobilization or little movement. It is a sub-role that can be quickly switched to the guard repositor sub-role, for example.
BACK TRUNK MOUNTER*(montador do tronco de costas)*	The fighter seeks to mount on the trunk of the opponent who is on their back. This constitutes a different sub-role from the previous one, as the rules state that both situations can be sought in a direct transition from the front mount to the back mount. Again, through the analysis of the fight videos, the internal logic of BJJ indicates that equivalences will only appear within each of these controls and domains, not all of which can be considered as a single sub-role. It is necessary to look at both the scoring rules and the relationship with the opponent (target space: part of the body to be dominated, controlled, crossed, transited, or avoided). This is a scoring sub-role (four points) when: the athlete who is on top and already free of the half-guard sits on the opponent's torso with their back and keeps both knees or one foot and one knee on the ground, facing the opponent's head opponent and with up to one arm of the opponent trapped under their legs, keeping it that way for three seconds (16).
KNEE-ON-BELLY PLACER*(colocador do joelho na barriga)*	The free guard fighter has the clear intention of placing their knee or shin over the opponent's belly, chest, or ribs to dominate them. This is a scoring sub-role (two points) when: the athlete who is on top and free from the guard, places the knee or shin (of the leg closest to the opponent's hip) on the opponent's belly, chest, or ribs, and who must be either standing upright, on their back, or on their side, keeping him/herself stable in this position for three seconds without the opposite knee touching the floor (16).
TRUNK CONTROL ESCAPER*(escapador do controle do tronco)*	The fighter tries not to accept control/immobilization of their torso by the opponent, pushes and moves away from the opponent but does not demonstrate any other tactical intention besides avoiding being immobilized. They can even try to reverse the position from bottom to top in relation to the opponent to escape. This sometimes presents itself under strong immobilization or little movement. After escaping from the immobilization, they can demonstrate a motor behavior to leave that position with a visible intention of restoring their guard; thus, they are already in another sociomotor sub-role.
GUARD RECOVERY *(recuperador de guarda)*	The fighter no longer has the opponent under their guard and tries to have their opponent between their legs again, aiming to have their opponent under their leg guard. They work to embrace at least one of the opponent's legs with their legs, seeking space by pushing, pulling the opponent, evading the hip, or rolling over their shoulder in an attempt to find space to imprison the opponent between their legs again.
BACK-MOUNTED ESCAPER *(escapador da montada de costas)*	The fighter, in an attempt to prevent the opponent from mounting on their trunk from the back, or when already mounted, defends themselves by pushing the opponent's legs, unbalancing them and trying to find space to escape and seek another motor interaction. This sometimes presents itself under strong immobilization or little movement.
KNEE-ON-BELLY ESCAPER*(escapador do joelho na barriga)*	This sub-role specifically seeks to remove the opponent's knee from the fighter's belly, escaping the opponent's domain (pushing the knee, straddling the hip to get the opponent's knee off their belly, etc.).

of motor action, they gain a specific operational meaning that cannot have a double-meaning. This is what Parlebas (7) conceptualizes as an "operational definition":

> *"… definition with a predominance of the descriptive, enunciated in concrete terms of operations or observable actions, whose objective is to isolate the pertinent identifiable characteristics and susceptible to being subjected to control and, eventually, also measures"* (7).

The sociomotor sub-roles were named considering the dominant motor interaction. Fighters are not obliged to fulfill all the sub-roles during a fight; however, when fighting BJJ they will have their motor acts channeled into some of them according to their interactions with the opponent, their strategies, motor decisions, technical-tactical level, affective and relational motivations, characteristics and physical capacities, as well as by the characteristics of the teaching-learning process of the school/academy. Therefore, the concept of IL is fundamental because it denotes, on the one hand, the presence of a system linked to the ludomotor contract and, on the other hand, it assumes a purpose and a praxis significance of the individual behaviors engendered by this system (7).

In general, considering the descriptions of the BJJ sub-roles, this Brazilian combat sport is characterized by presenting different motor interactions of grappling, dodging, grappling breaks, expectation, guard controls and their breaks, transitions, passes, inversions, domains, and submissions, as well as attempts to escape and defend these interactions. It is worth noting once again that all these interactions take place on the opponent's body at an almost zero guard distance without the possibility of percussive blows such as kicks, punches, elbows, and knees, among others, or the use of instruments such as sticks or swords.

3.2. Internal logic of Brazilian jiu-jitsu: the Ludogram of sociomotor sub-roles

From the 26 identified and described sub-roles, it is possible to build the BJJ Ludogram. The Ludogram consists, according to Parlebas (7), of the "graphic representation of the sequence of sociomotor sub-roles (and eventually the sociomotor roles) assumed by a player, successively, during the development of a sports game". The author also points out that this valuable instrument will be able to support deeper analyses such as the nature of motor decisions, characteristics of motor behaviors,

motor strategy, and the variability of praxic sequences. With this, it is possible to highlight the possibilities that this tool can represent to know and understand the motor conducts of a BJJ fighter. Along with this, this theoretical instrument enables the graphic representation of the sub-roles assumed by the fighter throughout the duration of a fight. Here, the BJJ Ludogram (Figure 1) is presented with an explanatory caption for each of the variables that make up the graph so that teacher-researchers can become familiar with the instrument.

In key (A), there is the general information of the Ludogram: identification of the participating fighters (name, age division, graduation, weight categories, time of the fight, video link of the fight, event, and phase of the fight) and the time of reference for analysis of the itineraries of sub-roles in relation to the time of the fight or the time of the analyzed video.

Key (B) of the Ludogram contains three sections: the score system, sub-roles, and the chart recording the motor itineraries. Regarding the score, it is possible to identify the number of points for each sub-role, punishments, and advantages. The score of the sub-roles is identified by colors: blue sub-roles are worth two points; yellow sub-roles are worth three points; red sub-roles are worth four points; and gray identifies a finalization sub-role. Punishments can be signaled in any of the sub-roles, while the accounting of advantages refers to the scoring sub-roles.

In the second section of key (B), the 26 BJJ sub-roles are presented, which were categorized into three sub-role bands and one band (Stopped Fight) to identify the record of fight interruptions during the confrontation. Each sub-role band is detailed below.

- **White band, referring to non-scoring sub-roles**: on alert, grabber, grapple breaker, dodger, guard puller, guard controller, guard breaker, and trunk controller.
- **Light pink band, referring to the scoring sub-roles**: thrower, sweeper, and knee-on-belly placer (two points); guard passer (three points); and front trunk mounter, back trunk mounter, and back dominator (four points).
- **Light yellow band, the sub-roles of escapes, defenses, throws, and impediment**: throw defender, sweep defender, submission defender, back-mounted escaper, front-mounted escaper, escaper from the domain of the back, guard recovery preventer, guard recoverer, knee-on-belly escaper, and trunk control escaper.
- **Light orange band, indicates the stopped fight moments throughout the combat**: interruptions made by the arbitration (exit from the fight area, adjustment of the fighters' kimono, etc).

The third section of key (B) consists of marking the itineraries of the sub-roles assumed by the fighters in relation to the time of the fight or the analyzed video. This space on the chart is intended to record the trajectory of the sub-roles successively

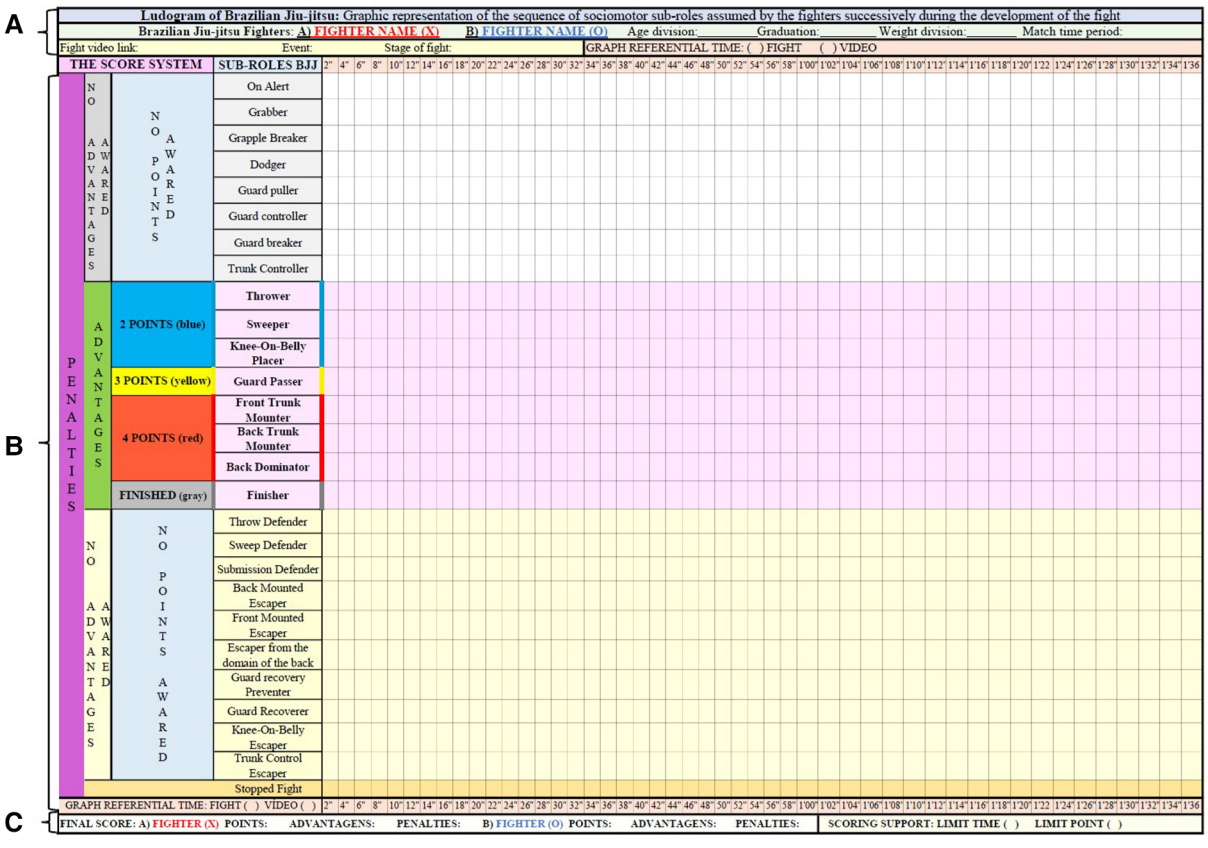

FIGURE 1
Ludogram of Brazilian jiu-jitsu. (A) general information; (B) score system, sub-roles, and graphic record; (C) final score and score support.

adopted by the fighters. To mark and differentiate the itineraries taken by the fighters in relation to the time of fight or video, one fighter is identified with the caption (X) in red and the other with (O) in blue. Due to the speed of BJJ sub-role changes, it is suggested that each quadrant on the horizontal axis indicate the time in seconds (between 1 and 2 s) or as needed.

At the bottom of the graph, key (C), the final score of each fighter is presented in relation to the score, advantages, and penalties, as well as the score support that will indicate whether the fight was finalized by time limit or score limit. After these initial highlights, **Figures 2**, **3** show an example of a Ludogram with the graphic record of the fighters' itineraries.

These two figures represent the records of the itineraries of the sub-roles of the two fighters identified and differentiated by the legend X and O of a fight from the beginning to the end. In addition to the caption in each space of time, it is necessary to draw a line that expresses the path taken by the fighters, allowing a better visualization of the dynamics of exchanges of the sub-roles during the combat.

In addition to recording the itineraries undertaken by the fighters, it is possible to express in the Ludogram the advantages, penalties, submissions, scores, and their values along the graph that are identified by colors. This information is marked in the quadrant with the corresponding color in relation to the fight time in which it is obtained. Therefore, it is necessary for the observer to enter the corresponding color of the score, penalty, or advantage in the quadrant in relation to the fight time or video for each fighter. At the end, the researcher/teacher will have, in addition to the assumed sociomotor sub-roles, the record of successes and failures regarding the scoring system. With that, the Ludogram also expresses the score interactions achieved by BJJ fighters.

4. Conclusion

The results of this research regarding the identification and description of the BJJ sub-roles corroborate and expand the analyses by Schmidt and Ribas (5), who pointed out that this is a body combat sport practiced in a stable environment with oppositional sociomotor interaction; a duel between two individuals with a target-space objective of the motor interactions in the opponent's body with motor interactions pertinent to practices classified in the almost zero guard distance (gloveless combatants, with permanent contact between the fighters that authorize and codify the combat on the ground, and with one of the objectives being to knock down the opponent).

The identification and description of the BJJ sub-roles revealed a complex web of possibilities imposed on the participating fighters by their internal logic. It qualifies BJJ as an oppositional sociomotor practice that requires from its fighters incessant decision-making and modifications in their motor strategies during the duel.

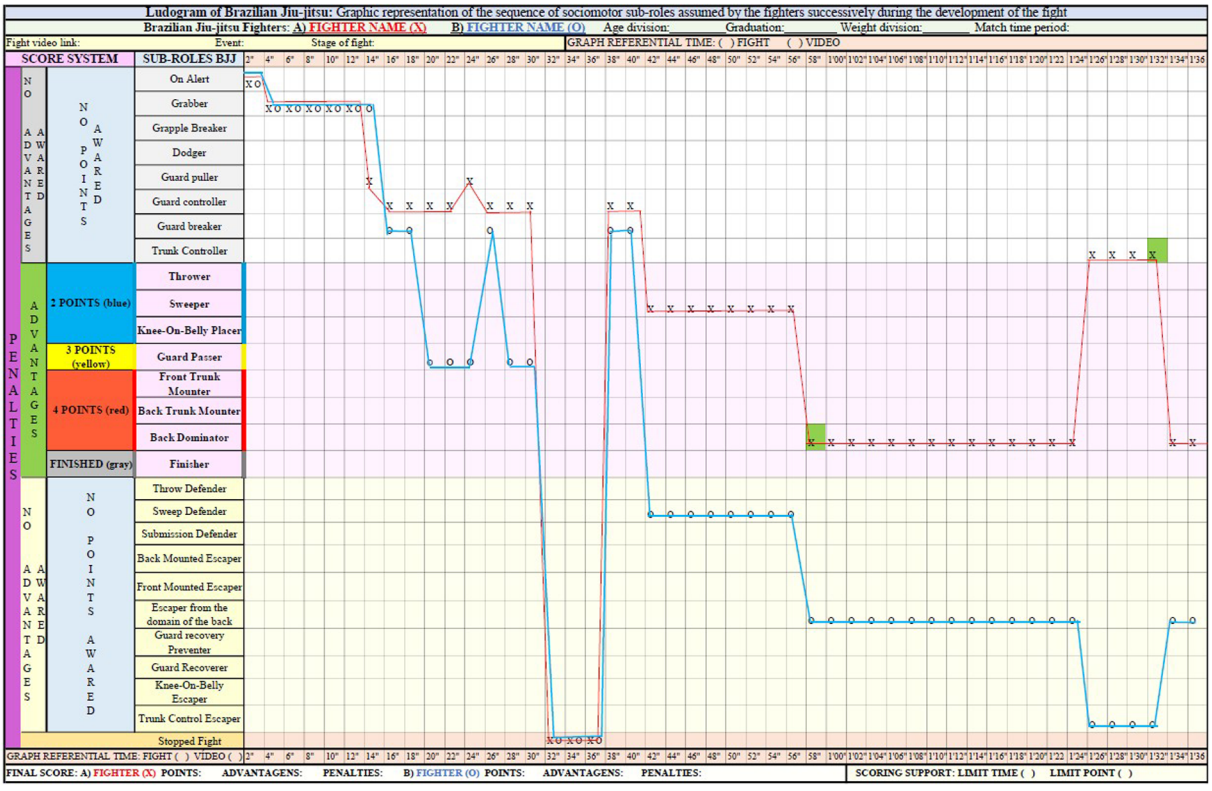

FIGURE 2
Example of a Ludogram recording of a BJJ fight (part 1).

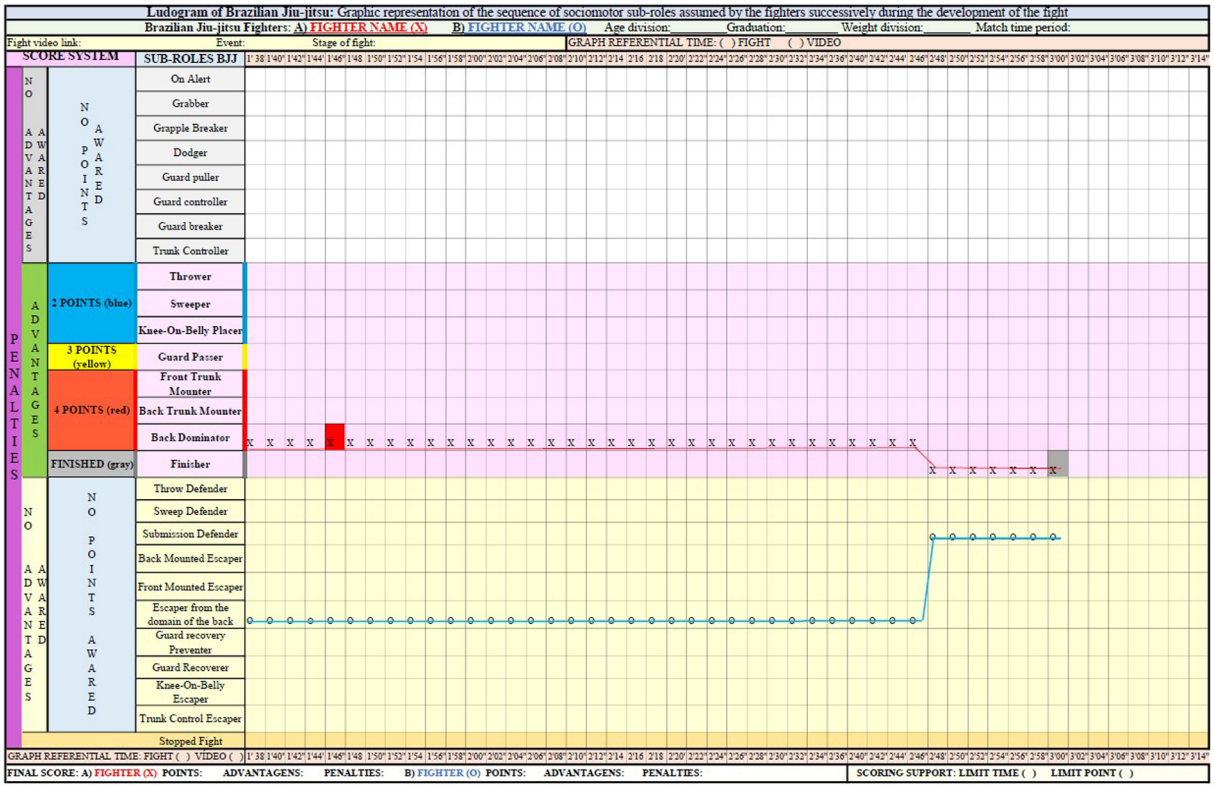

FIGURE 3
Example of a Ludogram recording of a BJJ fight (part 2).

The 26 identified and described sub-roles of BJJ indicate the richness of choices and possible paths to be followed by fighters within this itinerary of motor interaction. They are: on alert, grabber, grapple breaker, dodger, guard puller, guard controller, guard breaker, and trunk controller; thrower, sweeper, and knee-on-belly placer; guard passer, front trunk mounter, back trunk mounter, and back dominator; and throw defender, sweep defender, submission defender, back-mounted escaper, front-mounted escaper, escaper from the domain of the back, guard recovery preventer, guard recoverer, knee-on-belly escaper, and trunk control escaper. These different BJJ sub-roles described in this research highlight the importance of the concept of praxis communication, specifically, motor counter-communication, since many of the dynamics between a fighter's sub-roles refer to the choices that the opponent indicates for the motor dialogue.

If on the one hand there are the less desired sub-roles, on the other hand, there are the preferred itineraries, those with greater control and, if that weren't enough, some of them modify the score. Of the 26 sub-roles revealed, can modify the score of this combat sport.

Respecting the specific scoring rules, when successfully assumed by the participating fighter, the sub-roles of thrower, sweeper, knee-on-belly placer, guard passer, front trunk mounter, back trunk mounter, and back dominator add up to points on their score over the regular time of the fight, but they are not able to end the fight by maximum score. This is only possible when the fighter is successful in the finisher sub-role, which ends the fight before the maximum time limit set, usually due to the opponent's withdrawal and/or submission.

The characteristic of BJJ's internal logic referring to the score shows that this Brazilian combat sport significantly altered its motor objectives. Before, if the objective of the fight was self-defense and submission of the opponent, now, with the creation of the scoring system, the fighters can also guide their motor decisions towards score counter-communication interactions.

Each sub-role safeguards the objective characteristics of the interaction logic, but they will be assumed by different subjects of the action who will express their personality through each one of them. Are affective, relational, cognitive, and organic issues similarly activated in the different BJJ sub-roles? Is overcoming oneself in front of the opponent exactly the same in the sub-roles that allow scoring in relation to those that do not? Would relativizing defeat and victory also be the same in view of the different sub-roles that a fighter assumed during a fight? Will losing and winning a fight through maximum score (success in the sub-role of submission, failure in the sub-role defender of submission) reveal the same activations on the motor behaviors of those fighters who won or were won by score?

Recognizing the motor behavior of BJJ fighters is looking beyond the techniques or movements and trying to recognize the subject in its entirety during the motor actions in order to serve

to establish new pedagogical objectives. It reinforces the importance of the need for experience and experience that each of these dynamics and minimum interactions of BJJ can request from participating fighters. It is emphasized that the motor behavior and its competences (cognitive, affective, relational, and organic) must necessarily be observed during the motor practice as a behavioral procedural knowledge and not as a declarative knowledge. It is in this sense that the Ludogram stands out as a theoretical-scientific instrument that can support the objective understanding of this behavioral procedural knowledge based on the internal logic-motor behavior relationship.

The BJJ Ludogram enables future praxeological analyses of the sub-roles and motor behaviors of any subject who wants to assume the sociomotor role of a BJJ fighter according to the rules of this Brazilian combat sport. The characteristic variables of the players, age, sex, fighter's belt Üategory, capacity for initiative, and technical-tactical levels, among others, will be able to describe and aid understanding of different groups of fighters in terms of their motor behavior and motor conduct. It is important to emphasize that the instrument should be validated in future studies.

BJJ, as a practice with opposition interaction, requires from participating fighters incessant activations on aspects related to socio-motor intelligence, such as the need for socio-motor empathy, motor strategy, pre-acting, developing the capacity to make motor decisions, the ability to anticipate anticipations, to recognize the affective, cognitive, relational, and organic loads activated during the fight, and to develop their motor behavior.

Within the scope of didactic-pedagogical implications, the teacher/coach in possession of this new knowledge related to this motor practice and, inserted in a concrete reality, will be able to evaluate and plan the pedagogical interventions, bringing students/athletes closer to significant experiences of this motor practice when developing the pedagogical objectives coherently with the possibilities that this inseparable internal logic-motor behavior relationship can provide.

Thinking through the MP and the IL relationship and the concept of motor behavior means abandoning a mechanistic conception of physical education to introduce possibilities for a systemic, contextualized, and optimized physical education in its place. At the same time, it is necessary to dialectically articulate the internal logic with the external logic to enable a critical understanding of the social context of the social context in pedagogical practice. If there is an internal logic, it means understanding that there is also an external logic. From this relationship, it is understood that the starting point for this problematization in the scope of pedagogical practices, which work with sports games, consists of understanding that the very motor behavior of the subject who plays, fights, and participates in the praxeological system already presents elements of external logic.

The activations of the motor behavior of the subject of the action provoked by the internal logic of a sports game can be an effective way of bringing to light the traits of the society in which this historical subject is inserted, when considering the different dimensions of the motor behavior (organic, relational, cognitive, affective, social, etc.). That is, at the same time that it is inserted in an IL of a sports game, it also contains registered in its motor behavior aspects of the external logic in which it is also inserted. This question can be expanded even more if the concepts proposed by Pierre Parlebas of ethnomotricity, habitus, and playful contract with internal logic are articulated, a step that is only possible with the development of praxeological science.

The knowledge generated by the description of the internal logic of BJJ, specifically the identification and description of the sociomotor sub-roles and the production of the Ludogram, indicate new possibilities for scientific studies, among them: to infer the didactic-pedagogical implications of these results in pedagogical practices; to understand/signify the motor behaviors of the participating fighters based on the praxeological system and subject of action in BJJ; and to produce new analyses based on the Ludogram about participating fighters (decision making, fight strategies, etc.) in the different contexts in which BJJ is inserted.

Data availability statement

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The concordance game: A simple tool to estimate breath hold swimming performance and to teach dynamic apnea

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Introduction: Swimming is composed of several phases. One of them is done underwater in apnea. Although this phase takes an important part of the performance, it is not taught much because of the risk it entails. At the same time, learning apnea can reduce the fear of immersion and, thus, reduce the number of drownings. The pedagogy used in this paper comes from game theory. This paper tested an apnea game based on the agreement between self-prediction and realization of the task.

Methods: Considering the preliminary level of the 33 sports students involved, the game offered two choices: swimming apnea over 15 or 20 m with a distribution of payoffs depending on the actual achievement (15 m estimated and less than 20 m performed = + 3 points; 15 m estimated and at least 20 m realized = + 1 points; 20 m predicted and less than 20 m realized = + 2 points; 20 m estimated and at least 20 m realized = + 4 points).

Results and discussion: Concordance was favored over discordance, including in the swimmer's comfort zone (15 m). Throughout six apneas the results showed that the structure of this game supports the improvement of the estimation of the distances swum. The "Concordance Game" could be offered in Physical Education or in a sports club to learn to swim a longer distance below the surface without forcing.

KEYWORDS

Physical Education, dynamic apnea, self-knowledge, concordance, performance, game theory, teaching games, motor praxeology

Introduction

Human fascination and fear of water and apnea occur in every period of history and civilization. There is a major contradiction between the extraordinary human adaptations to immersion—bradycardia, decreased systolic ejection volume, peripheral vasoconstriction, splenic contraction in deep diving (Mayol, 1986)—and the terror associated with drowning, whether at school, in a swimming club or any other aquatic activity (Collard, 2018). It crosses more globally in Western history from the Middle Ages to the present (Chauvaud, 2007). This

terror probably comes from the fact that underwater, even in a lighted and heated swimming pool, the external senses that usually ensure our safety are troubled. The view is blurry (Luria and Kinney, 1970), the field of vision is reduced, and sound travels five times faster while giving muffled signals (Kinney et al., 1970). The proprioceptive markers are also distorted (Counil et al., 2012; Ma, 2021). The kinesthetic sense is damaged. To be convinced, all you have to do is kneel at the bottom of a swimming pool (by draining enough air from your lungs) and try to put your arms horizontally with your eyes closed. By reopening them to control the horizontality of the arms, we might find that they are oblique—the pressure of the water (more than 800 times denser than air) distorts our sensations of movement. American swimmer, Mark Spitz, reported he was convinced that he was swimming with his arms outstretched before NASA's pool cameras revealed that he was bending them during every underwater action (Counsilman, 1968). The labyrinthine sense is also disturbed. The human inner ear sends constant commands to the cerebellum to regain the surface (Silbernagl and Despopoulos, 2007), while evolution has endowed marine mammals with tiny semicircular canals to avoid "seasickness" in the submerged position (Thewissen, 2014). The change in the environment has disturbed our senses. It is, therefore, important to adapt to the changed proprioception and to learn new skills (Fitts, 1964).

As explained (Parlebas, 2008) in the lexicon of motor praxeology, game theory is a mathematical discipline that studies situations of confrontation or conflict from the perspective of rational decision-making. It is a theory according to which many situations are studied in order to define so-called optimal success strategies. This paper proposes to emphasize the motor action rather than the success strategy through the sporting game theory. Indeed, the aim here is to use sporting game theory as a pedagogical tool. Nobody clearly knows how to swim properly, and even fewer are able to perform an apnea for any length of time or depth, as the following examples show. When teaching swimming at school or in clubs, it is sometimes interesting to confront swimmers with immersion phases. However, from a safety point of view, this is quite challenging. In our research, we have observed an improvement in performance in dynamic apnea in students confronted with game theory, while respecting the safety rules of underwater activity.

During a pre-experimental phase realized at our university, 18 sports students in STAPS (Sciences and Techniques of Physical and Sports Activities) were estimated and then performed their maximum distance in dynamic apnea. With the exception of a few swimmers who exceeded 20 m, most swimmers returned to the surface at around 15 m. The oxygen saturation rate (O_2)—measured 30 s before and 30 s after their apnea—reveals that the subjects only used up to 5% (SD = 2.3) of their O_2 reserve during the dynamic apnea test (compared to 40% for a confirmed free diver measured with the same oximeter). Most students underestimate, therefore, their capacity to perform apnea.

The literature review identifying the estimation of swimming skills shows that young men are more optimistic in their estimations than young women (Howland et al., 1996; Gilchrist et al., 2000; Gulliver and Begg, 2005; Moran, 2006; MacCool et al., 2008). But these estimations are rarely verified in action or they are verified but indirectly. The difficulty is to measure aquatic performance without endangering participants (Fisher, 1981; Rudisill et al., 1993; Wiesner and Rejman, 2014; Martínez-Santos et al., 2020). In aquatic environments, knowledge of the potential gap between estimation and result of performances largely improves successful active pedagogy (Raudsepp and Liblik, 2002; Sollerhed et al., 2008; Blitvich et al., 2011; Stillwell, 2011; Wang et al., 2013). Additionally, protects from the risks of drowning (Rahman et al., 2009) and lowers the estimation of danger (Baker et al., 1993).

Most of the tests have been designed to measure skills in sports environments (over aquatic activities) and organized as a game for a player, referred to in a game theory as "play against nature." These are stress tests and physical quality tests correlated to psychological and social variables (Sollerhed et al., 2008) or anthropometric data (Szczesny, 1983). These tests are also duels or strictly competitive play (where everything that one gains, and the other loses (Shubik, 2006; Parlebas, 2010). Based on performance through conflict, they are predisposed to risky behavior (Bay-Hinitz et al., 1994; Collard, 1998).

An analysis, proposed by Moran et al. (2012) *via* a role-playing game called "play against nature," reveals a significant correlation between estimating and performing according to a surface swimming protocol. In the experiment, participants were asked if they were able to achieve different swimming tasks. It was a positive correlation for the following tasks: swim the farthest in 15 min, stay as long as possible on the surface while holding their breath, and swim 100 m in backstroke. They were also asked if they were able to swim underwater. Sixty-two percent of the participants answered that they could. Only 37% were really able to swim more than 20 m. The authors concluded that there is no correlation between the estimation of the performance and the reality of swimming 20 m in dynamic apnea ($r = -0.134$, Spearman's rank correlation).

Another study (Collard et al., 2015) proposes a pure coordination game (Crawford and Haller, 1990) in which swimmers had to agree on the distance that they would swim underwater after diving into a swimming pool. The swimmers were not able to communicate with each other. To win the game, the swimmer had to surface at the same point as his partner. The results revealed that swimmers underestimate their competence when they are not subjected to a competitive challenge. In fact, they estimated their performances according to the Schelling point.

According to previous studies about game theory, strictly competitive games were sidelined (due to excessive risk-taking) as were games of pure coordination (by the lack of confrontation). The game of dynamic apnea (called "The Concordance Game" or CGame) using new skill experiences helps the external and proprioceptive stimuli to refine a body scheme (Ono and O'Reilly, 1971; Kerr, 1973; Parlebas, 1999; Berthoz, 2000).

The purpose of this paper is to improve dynamic apneas through game situations; improve self-awareness by confronting estimation of the degree of achievement (self-fulfilling prophecy) and the realization of actions (i.e., by swimming); and ensure the safety of swimmers by avoiding the risky maximal performance. Finally, this study aim at proposing a new tool that may be reinvested for swimming ability in sports training or Physical Education (Pelayo et al., 1999).

Materials and methods

Participants

Prior to the test, all subjects signed a written informed consent in accordance with the principles outlined in the Declaration of Helsinki in 1975. Participants were all sports science students at the school of sport sciences (i.e, Unité de Formation à la Recherche (UFR) STAPS) from the Université Paris Cité, France. Students were volunteers to participate in the CGame. The proposed swimming situations are part of their training cycle. Therefore, in case of an accident, students are insured by their university. An initial group of 53 male participants (18–20 years of age: x = 18.6; SD = 0.79), with the capability to swim at least 440 m in 10 min participated in this experiment. Thirty-three of the 53 participants are able to swim between 15 and 17.5 m underwater and are, therefore, selected to participate in the CGame (**Table 1**). The other 20 swimmers were not chosen because they had not reached the 15-m threshold or had already exceeded 20 m. None of the 33 swimmers recruited for the experiment had ever practiced apnea, either at school or in a sports club.

Dynamic apnea game

To improve the apprehension of aquatic immersion by participants, the Concordance Game was proposed. The game was carried out in a swimming pool. The pool was 50-m long and 1.8-m deep. Moreover, there were no markers that could give information about the distance swum under the water surface. Placed next to the trunking, a plastic cone shows the 15 m and another the 20 m—only in view of the experimenter (and the swimmer's when resurfaced). Each swimmer estimated the feasible distance they thought they could reach during apnea. Distances were restricted to 15 and 20 m. E15 and E20 refer to 15 and 20 m predictions, respectively. The start was underwater. When the swimmer resurfaced before 15 m, the game stopped, and the swimmer tried again without being penalized. When the swimmer exceeded 15 m and surfaced before 20 m, the trial was coded P15 (for "Perform 15 m"). A trial strictly or exceeding 20 m was coded P20 (for "Perform 20 m"). The following payoffs were known to everyone:

- E20-P20: the best estimation and performance, they scored four points.
- E15-P15: when the swimmer successfully performed their estimations, they scored three points.
- E20-P15: when the swimmer performed less than estimated they still pocketed two points, corresponding to a relative underperformance without compromising their security, an extremely important rule not to be neglected.
- E15-P20: when the swimmer performed more than estimated, they only scored + 1 point. This was the worst score because, in apnea, exceeding the estimated distances was potentially exceeding one's limits (=danger).

Matrix 1. Payoffs associated with the two estimations (E15 and E20 for estimate 15 or 20 m) according to the performance swum (P15 and P20 for performance on 15 or 20 m).

M1	P15	P20
E15	+3	+1
E20	+2	+4

If swimmers were meaningful virtual players, they would first avoid the worst. The tactic of the lesser evil by playing E20, called "Maximin" (von Neumann and Morgenstern, 2007) allows scoring + 2 (i.e., by trying to swim as far as possible but unsuccessfully). By playing E15, a minimum profit could be obtained + 1. By playing E20, this minimum profit rose to +2 points (noted: Max (1, 2) = + 2). This choice was a reliable solution since it enabled the dominant strategy (E20, P20) = + 4 points: the optimal balance of the game.

TABLE 1 Distribution of students according to the distance swum.

Distance (m)	5	7.5	10	12.5	15	17.5	20	22.5	25	>25
Number of students	0	0	0	9	**18**	**15**	9	1	0	1

Only the 33 sports students highlighted are selected for the CGame.

A bold estimate was, therefore, fostered. The "Minimax" tactic is defined by the minimum of the maximum satisfaction; it was given by Min (3, 4) = + 3. This Minimax also corresponded to a balance (E15, P15): resulting from a significant "comfort" strategy. This strategy was, however, less robust than (E20, P20). Nevertheless, greater consistency between estimations and realizations improved the scores (+3 and +4).

As swimmers had six trials in that game, the game did have a balance in mixed strategy (Nash, 1950): Let p be the probability of playing E15 and $(1–p)$ the probability of playing E20. Then, the gain expectation if P15 is EP15 = $3 \times p + 2 \times (1–p) = p + 2$ and the gain expectation if P20 was EP20 = $1 \times p + 4 \times (1–p) = 4–3p$. To play the balance, we put EP15 = EP20, in other words, $p + 2 = 4–3p$; it came $p = 1/2$ and therefore EP15 = EP20 = 2.5 points. This result was better than Maximin but not as good as Minimax. It was assumed that q was the probability of P15 and $(1–q)$ that of P20. Similarly, the equilibrium was in EE15 = EE20, i.e., $3 \times q + 1 \times (1–q) = 2 \times q + 4 \times (1–q)$. Then $2q + 1 = 4–2q$, $q = 3/4$ (probability of playing P15—and therefore 1/4 the probability of P20—to obtain a score of 2.5 points). In other words, by deviating from the comfort zone: E15 with P15 (Minimax = + 3), the player loses only −0.5 points by playing every other E20 in the hope of succeeding (P20) only once in four times. Everything was done to give the swimmer confidence to take the risk over the longer distance (E20) without risk to the score (+2 if Maximin, +2.5 if the balance in mixed strategy, +4 if the balance in pure strategy: he, therefore, avoids the worst = + 1).

If the players acted like a well-programmed computer without problems of apnea or distance recognition, they would systematically play (E20, P20) to obtain the maximum score (+4). But what strategy will be implemented by swimmers? The caution of the Maximin (E20) with the possibility of a maximum score (when exceeding 20 m) counteracted the balance of the Minimax (E15). The Minimax appeared simpler in theory, but practically, this choice could have induced the worst score: + 1. The solution could have also been adopted by a mixed strategy (playing E15 half the time and based on the assumption of resurfacing in P15 three times out of four).

Measures

The experimentation took place over the following three sessions with 1 week between each.

(i) In the first session, an identical pre-test for selection is carried out for the 53 men. It simply consists of asking to "swim as far as possible underwater." Starting in the water without equipment (except goggles), the swimmers go one by one. Distributed every 2.5 m on the poolside, pull buoys indicate distances from 5 to 25 m. Before starting their apnea, everyone must estimate the distance they will browse before resurfacing. There are no marks underwater. Then, once their maximum apnea has been achieved, the swimmers resurface and continue other crawl exercises (unrelated to the investigation) in the ancillary corridors. For each swimmer, the distance where he emerges as close as possible to the marks (pull buoys) is measured, making it possible to compare the predictions with the achievements (**Figure 1**). Swimmers have no feedback on their underwater performance and cannot trade right after. Exercise is perceived as part of their training of the day (these are sports students who prepare a performance in a 400-m crawl at the end of a cycle of 10 sessions: the pre-test is placed in the middle of this cycle and the middle of other exercises).

(ii) In the second session, the game was explained to 33 selected swimmers from the CGame group. Each swimmer had six trials to perform—interspersed with other swimming exercises (mainly crawling). To motivate participants, the 10 overall best players obtained at the end of the game a bonus point on their swimming score. Each student had to write the prediction on the board before each trial. When they finished, the distance performed was written just beside their estimation. Results of each "estimate" (E) and "performance" (P) were reported in Matrix 2 (M2). The total results ($6 \times 33 = 198$ estimations followed by 198 dynamic apnea measurements), and the intermediate results at each stage of the game were presented, in order to see the possible strategic evolution (Matrix M3-M4-M5-M6-M7-M8). The payout expectation was calculated at each stage of the game. For their part, six maximum dynamic apneas (interspersed with other crawl situations) were offered to the non-recruited group of 20 swimmers. To provide feedback on performances when swimmers were resurfacing, pull buoys were placed on the side of the pool. No other action was taken with them regarding apneas.

(iii) The third session consisted of a post-test: the 53 sports students reiterated the pre-test (**Figure 2**). The results between estimations and achievements were compared between swimmers who participated in the CGame swimmer's session ($n = 33$) and residual swimmers ($n = 20$).

Results

Although their performance in maximum dynamic apnea was different, both the 33-CGame group and the 20 other students underestimated themselves during the first apnea (pre-test) in a way comparable to Chi^2 with $\chi^2 = 2.78$, dof = 1, $r = 1$, difference not significant (**Figure 1**). A small proportion of swimmers managed to match prognosis and performance (5/53).

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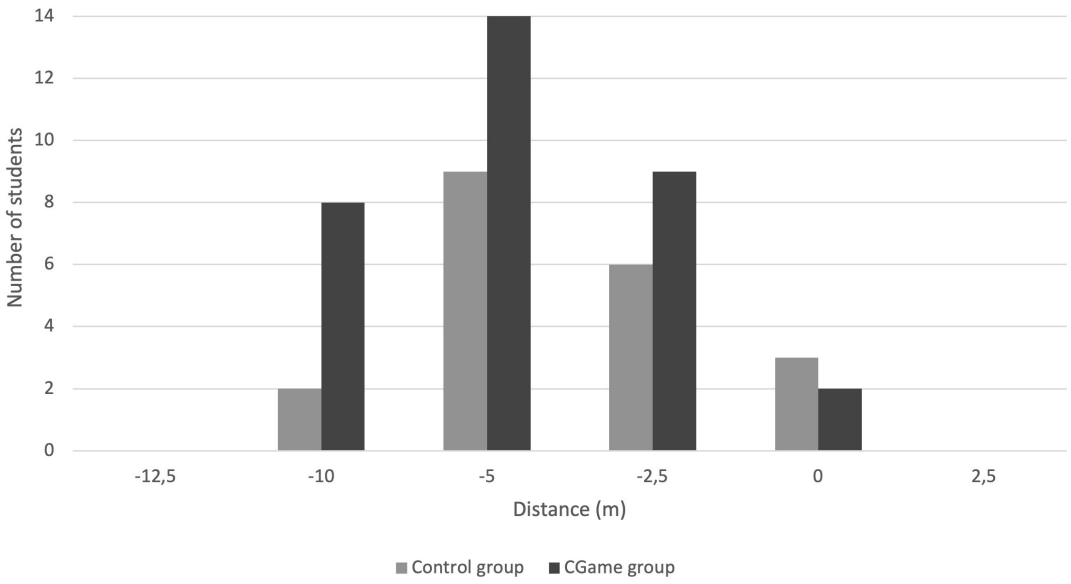

FIGURE 1
Difference of distance at pre-test apneas between estimation and the real distance performed for both groups. Vertically, the number of swimmers. Horizontally, the distance is in meters. The homogeneity test confirms that the groups can be considered as belonging to the same population (Chi^2 = 2.78, dof = 1, r = 0.1, NS). They are only underestimated, most often 5 m below the estimated distance.

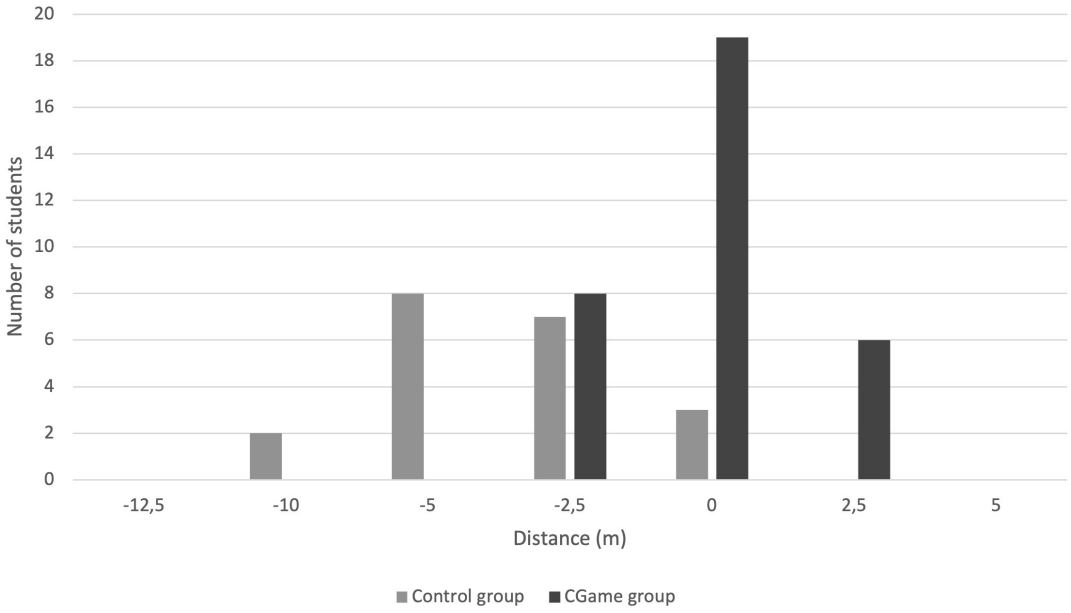

FIGURE 2
Difference of distance at post-test apneas between estimation and the real distance performed for both groups. The homogeneity test shows that the groups are to be considered significantly different (Chi^2 = 21.99, dof = 1, $r < 0.001$). We notice that 19 of the 33-CGame group swimmers achieved a perfect match between saying and doing (concordance). The remaining 14 CGame participants only deviated by a maximum of 2.5 m from the estimation. For the first time, there was overestimating (for six swimmers of the CGame group).

At the CGame itself, most swimmers first played Minimax = (E15, P15) = 49% (M2). Of the 198 passes, 36% played the optimum balance = (E20, P20), i.e., these players emerged to the surface at more than 20-m away, while none of the 33 swimmers selected reached this distance during the pre-test (Table 1). Concordant strategies are those whose estimated and performed swimming distances are the same. Conversely, discordant strategies are those

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whose estimated and performed swimming distances are different. During the game, concordant strategies were much more present than non-concordant strategies (E20, P15) and (E15, P20) which were observed in 13 and 2% of cases, respectively. In the end, the game itself yielded an average payout: EM2 = + 3.2 points per move, better than Minimax and Maximin, and less than the optimum balance in pure strategy (that a machine would have played).

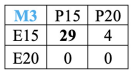
Matrix 2. Distribution in the four strategies of Matrix 1 of the 198 trials.

M2	P15	P20
E15	97 (49%)	5 (2%)
E20	25 (13%)	71 (36%)

Strategies tended to evolve during the game. At the first step of the game (Matrix 3), the swimmers remained in their comfort zone [29 of the 33 players played (E15, P15)]. Only four of them—due to a lack of underwater landmarks—surfaced too far, beyond 20 m, and obtained the worst score = + 1. This fear of the worst gradually affected the whole group. Between Matrix 3 and Matrix 5, more than a dozen swimmers moved away from E15, and none were trapped in (E15, P20) = + 1. The expectation of gain increased significantly, from + 2.7 points in M3 to +2.9 points in M4 and M5. In M5, the swimmers' way of playing was similar to the one given by Nash's balance (p = 1/2 and q = 3/4, E = + 2.5).

Matrices 3, 4, and 5. Evolution of strategies during the first three trials of the game.

M3	P15	P20
E15	**29**	4
E20	0	0



M4	P15	P20
E15	**23**	1
E20	5	4

M5	P15	P20
E15	**18**	0
E20	9	6

In the middle of the game (Matrix 6), the distribution of strategies was more diverse than at the beginning (Matrix 3) and the end (Matrix 8). Henceforth, this distribution moved away from the probabilities rendered by the calculation (and observed in Matrix 5). In Matrix 6, it was rather p = 1/3 (11/33) and q = 1/2 (17/33). Symptomatic of greater self-confidence, Matrix 6 corresponds to the moment when more students chose the E20 tactic rather than the E15. The game switched at this time. The expectation of gain gains: EM6 = + 3.3: EM7 = + 3.5, EM8 = + 3.7. Players did better than the theoretical mixed balance gives. The improvement in the expectation of gain was also due to the gradual disappearance of divergent strategies [a single strategy: (E20, P15) in Matrix 8]. Comforted by a game mechanic that was benevolent toward risk (swimming over 20 m), most players ended up playing (E20, P20): 24 of the 33 swimmers in Matrix 8, whereas none of the 24 surfaced at 20 m during the first session.

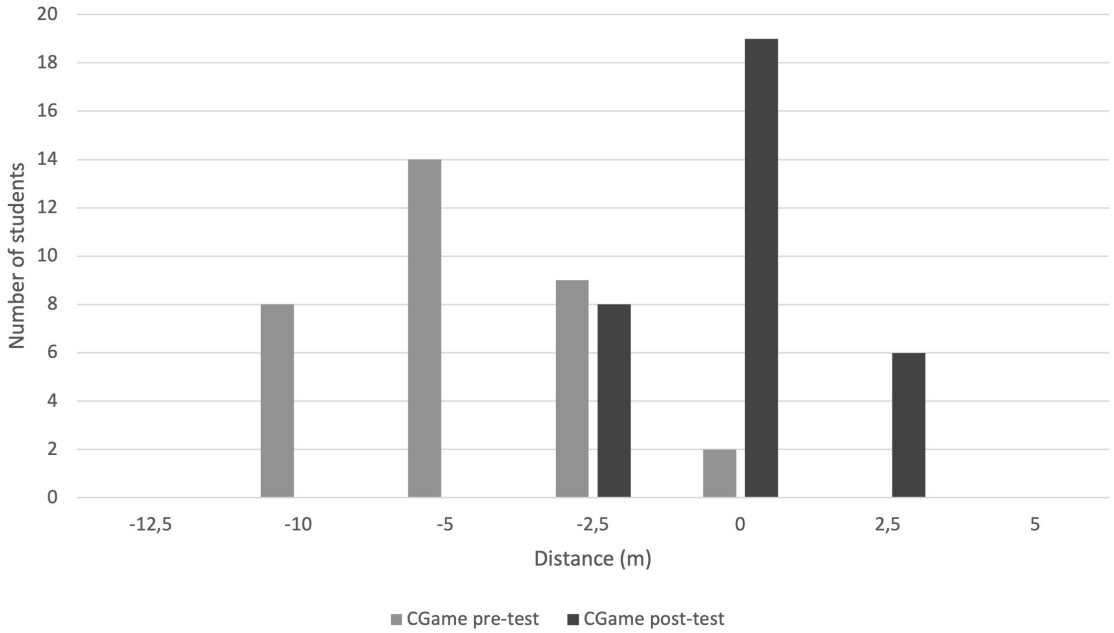


FIGURE 3
Difference between prediction and maximum pre-test and post-test apneas for the CGame group. The differences before and after the exercise of the CGame are significant (Chi^2 = 41.82, dof = 1, r < 0.001). The conjunctions between saying and doing are much closer at the end of the game.

Matrices 6, 7, and 8. Evolution of strategies during the last three trials of the game.

M6	P15	P20
E15	11	0
E20	6	**16**

→

M7	P15	P20
E15	8	0
E20	4	**21**

→

M8	P15	P20
E15	8	0
E20	1	**24**

At the end of the game, during the post-test, the CGame group progressed in the estimation of the distances swum in apnea unlike the non-recruited group which stagnated (**Figure 2**). When there were differences, they were only underestimated for the CGame group (**Figure 3**). The CGame did influence the estimation of apneas.

Discussion and conclusion

The present study reported significant progress in apnea performance in the CG group, but no evolution had been reported for the residual group. In addition, the best swimmers also improved their performance after six repetitions of maximum apneas. For each performance level, we could enlarge a suitable CGame, with E20 and E25 for the best and E10 and E15 for swimmers with fewer capabilities.

The most surprising result of this study is probably a lack of progress. The difference between estimated and performed apneas of the residual group is equivalent (except for one swimmer) before and after having done six maximum dives without instructions (**Figure 1** *vs.* **Figure 2**). This lack of progress contrasts with the results obtained thanks to the implementation of the CGame (**Figure 3**). To match the predictions and achievements, all the CGame players reported adopting a strategy of counting the number of strokes in an attempt to match the predictions and achievements. For example, eight movements in breaststroke from the wall to 15 m followed by three additional ones to pass the 20 m. This objectification of underwater distances is very classic in sports swimming. Thus, Michael Phelps systematically made 10 undulations after each dive to reach the surface at the 15-m buoy (beyond which he would have been disqualified). In aquatic environments, visual cues are subordinate to kinesthetic information (Collard et al., 2007). It seems that in the absence of a challenge, control of movements by counting failed. Thus, at the post-test, no swimmers from the residual group declared to have counted their arm strokes.

The strategic evolution at the CGame for the 33 swimmers is quite close to rational behavior. The swimmers started by playing Minimax (+3). Then, some swimmers moved away from it by playing Nash's balance in mixed strategy (p and q close to 1/2 and 3/4 in M5). They sometimes lost but never fell below + 2 (Maximin). The expectation of gain had not even stopped rising. Finally, almost all of them had oriented themselves toward the optimum balance in pure strategy (+4). The mechanics of the game have shaped behavior—like a prisoner's dilemma (Tucker and Straffin, 1983) that invites admission of the crime, even if nothing has been committed, or a Dove vs. Hawk (Dawkins and Davis, 1976; Binmore, 1992) that induces the survival of conciliatory behaviors in the middle of the power struggle. The master of the game is not the master or the player but the game. As a result, the CGame seems to us to be an interesting pedagogical tool for those who want to provoke progress between estimates and realizations of apneas.

The objective of the CGame is to adjust the participants' body scheme to the underwater space to ensure safety. Drownings are most often the result of a lack of awareness of their potential for action. Syncope is linked to a physiological characteristic of the human species (Silbernagl and Despopoulos, 2007). Hyperventilation—even if not forced—which usually prepares apnea, significantly reduces the level of carbon dioxide (CO_2) in the blood but almost does not increase the level of oxygen (O_2). However, the physiological mechanism that makes you want to breathe again at the surface (diaphragm spasm) is the level of blood CO_2 which is too high. In fact, while the CO_2 tolerance threshold has not yet been reached, the O_2 level may be too low, and the body goes into standby. If the swimmer is alone at the pool, drowning is guaranteed. It is, therefore, essential to get to know your own dynamic apnea abilities, and to objectify the relationship to underwater space—by counting, for example, the number of strokes in dynamic immersion before going up. This is what the exercise of the CGame led to, without being imposed. Additionally, the experimental game theory is undoubtedly a promising tool to cross perceptions with motor skills.

One of the possible approaches of our study can be done by the 360° approach used (Lavega-Burgués et al., 2020; Martín-Martínez et al., 2021). Through an observational methodology and T-Patterns, we could find out differences pre–post test throughout the temporal distributions events (Pic et al., 2022).

We used a pedagogy aimed at improving students apnea swimming performance. Indeed, the objective was not only to teach values about safety in the water but also to help them improve their performance. To meet these needs, the use of motor praxeology introduced by Pierre Parlebas with the theory of sports games allowed the swimmers to evolve. Indeed, at the beginning of the cycle most of the students overestimated their ability to swim underwater (this is a problem in view of the danger of apnea, if the swimmer is unable to swim what he/she has estimated then the risk of drowning is increased), this tendency was reversed at the end of the cycle. In parallel with the improvement in the estimation of their underwater swimming ability, swimmers saw their underwater swimming distance increase. The "Concordance Game" could be offered as a pedagogical tool in Physical Education or a sports club to learn to swim a longer distance below the surface without forcing and with respect for the safety rules.

To conclude, in view of the results obtained from "The Concordance Game," we can say that it is an interesting pedagogical tool. It allowed the students to improve their

dynamic apnea performance, by knowing more about their limits and by avoiding working in an unsafe way.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

LC designed and directed the project and performed the experiments. DV directed the project and developed the theoretical framework. DH wrote and translated the article. All authors thought about the method and discussed the results.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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How to understand sports and traditional games and how to apply it to physical education. On the "Goal of Game"

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Introduction: Does philosopher's stone exist in physical education? It could be said that teaching games for understanding approach (TGfU) keeps turning everything it touches into gold: its presence in the educational centers, its volume of publications, the way of teaching games and sports, its connections with other approaches, its game categories, learning transferable principles of play. But… no, all that glitters is not gold. There are TGfU issues that should be improved. For example, these categories are disconnected from each other because TGfU lacks classification criteria. The "goal of game" is a concept that has been studied, but it has not been applied to physical education. The aim of the article is to show how to deepen the understanding sports and traditional games from the "goal of game", and to propose its applicability to physical education.

Methods: The traits of "goal of game" will be identified by investigating two close concepts, "prelusory goal" (formalist philosophy of sport) and "motor-goal" (motor praxeology).

Results: The traits of "goal of game" concept: main-motor-problem, described in the game rules and that the players will try to solve during the game dynamics. The "goal of game" chances: (1) It allows us to understand sports and traditional games based on their internal logic (2) It allows us to classify traditional games and sports based on classification criteria and that can be useful to organize the physical education program; (3) It allows us to deepen the understanding of sporting games and their applicability to physical education: on the one hand, proposing progressively more specific goal of game options and, on the other hand, proposing a network model of intentions of play to understand the game dynamics and to design learning tasks.

Conclusions: The conclusions collect some properties of the "goal of game" concept in order to propose its applicability in physical education students learning: identify and compare the main-motor-problems of the games; solve these problems during the game dynamics; transfer the procedures used to solve other games. The goal(d) of game amazes us; maybe physical education teachers are curious to continue discovering this wonderful treasure.

KEYWORDS

goal of game, traditional games, sports, TGfU, motor praxeology, physical education, motor-goal

Introduction

Teaching Games for Understanding approach (TGfU) is notable because some merits. Its progressive diffusion in physical education (PE) (1, 2) has led to a substantial bibliography for practical application, theoretical foundations, and research (3–7).

Some teaching and research approaches have come closer to TGfU, such us motor praxeology (8, 9), constraints-led approach (CLA) (10), game-centred approaches (GCA) (4, 11), game sense (12, 13).

TGfU has modified the way of teaching and learning games and sports, making the students to focus their attention to the logic of the game dynamics (14). Compared to the traditional skill drill technical model (15), TGfU achieves higher motivation (16), strategic knowledge transfer (17) and student's connection to the activity (18).

The summary is that "*The Teaching Games for Understanding (TGfU) approach for games teaching in physical education is one such increasingly popular teaching approach that advocates a learner-centered orientation, with emphasis on exploratory learning within "gamelike" situations* (2)" (p. 252). It could be said that TGfU is the philosopher's stone of PE: it turns everything it touches into gold.

Furthermore, TGfU proposes categories, where each category contains games and sports whose design logics and game dynamics logics are similar: "*If teachers select or sample different games from the same category, children can be led to understand similarities between apparently dissimilar games within a game form. For example, basketball and soccer, as invasion games, can explore common principles of attack and defense. Also, differences between apparently similar games can be compared, such as tennis and badminton as net games* (19)" (*p*. 30).

Time is tight in PE. The student will not have to learn and practice countless games and sports in PE if a curriculum is proposed from game and sports categories (20). The objective is for the student to understand and retain the structures and game principles of each category and to reuse them in the practice of sports and games with similar internal logics (transfer) (17, 21,22).

The initial TGfU grouped games and similar sports into four broad categories. They are games similar to each other because they coincide in their designs and in their (tactical) principles of play (23). For instance, invasion games" (soccer, basketball, hockey, rugby) share: a goal or similar target for scoring, invading territory to make space in attack and the containment of space in defense.

This means that during the game dynamics of one and the other games and sports that belong to the same category, the student performs similar procedures (20, 24): similar intentions of play, similar decision-making, similar interpretations of game situations. It is worth pointing out this way of acting in PE proposed by the TGfU. This is precisely what the development of this paper will focus on (see **Table 1**).

The diversity of learning experiences in PE ensures the improvement of the spheres of the person (26) and of the student's motor-behaviour (27): affective, cognitive, motor and relational. But if a student spends many hours learning and practicing the same type of very similar games he will have less opportunity to take time to experience other beneficial experiences. For example, learning more and more invasion games (soccer, basketball, hockey, tag rugby, ultimate, lacrosse) implies a repetition of similar game experiences. Then, "*The focus of TGfU is to design learning experiences for individuals to acquire tactical skills of the major games through playing modified versions of target games considered suitable for their current physical, intellectual, and social states of development* (2)" (*p*. 253).

The learning and practice of games of diversity of categories ensures the diversity of experiences and its consequent influence in the spheres of the person (28, 29). This has implied that more and more categories have been added to the TGfU model over the years (6), for example, wrestling games (judo, wrestling, canarian wrestling) and combative games (taekwondo, fencing, canary stick game) (30), traditional sports and games whose goal of game is for players to throw a moving-object at other players' bodies (ball-tag games, paintball, dodgeball, sitting-ball) (31) and tag games (cops and robbers, kabbadi, kho-kho) (32, 33).

The games and sports included in these other categories also meet the requirements of being games similar to each other because they coincide in their designs and in their structures and (tactical) principles of play (23, 25). Then, the student performs similar procedures in these sports and traditional games during the game dynamics (20, 24). Then, they can meet the requirement of transfer between games belonging to a category (17, 22). And, finally, they can meet the other requirements of being major games, target games and being games considered suitable for their current physical, intellectual, and social states of development (2).

Other kinds of sports and traditional games that can perfectly meet part or all of the above requirements of the TGfU: traditional sports and games whose goals is for players to reach a goal-place

TABLE 1 The four categories of games chosen by the TGfU approach (this is a selection from the original table by Butler (25).

	Categories of games			
	Target	Striking/Fielding	Net/Wall	Invasion
Examples	Archery, bowls, golf, bowling, croquet, curling, pool	Baseball, cricket, kickback, softball rounders	Net: badminton, pickle-ball tennis table-tennis, volleyball	Basketball, field ice hockey, soccer, lacrosse, water polo, football, ultimate frisbee
			Wall: handball racquetball, squash	
Main intention of game	To send away an object and make contact with a specific, stationary target in fewer attempts than opponent	To place the ball away from fielders in order to run the bases and score more runs than the opponents	To send ball back to opponents so that they unable to return it or are forced to make an error	To invade the opponents' defending area to score a goal while simultaneously protecting own goal

(relay races, puss in the corner, musical chairs, king of the mountain, green light-red light), acrobatic games (artistic gymnastics, capoeira, trampoline), juggling, games of building human towers (castellers, acro-sport), games with music and rhythm (jump rope, rhythmic gymnastics, clapping hand games, aerobics). Definitively, more games and sports categories are needed in PE (29).

A PE curriculum that plans the practice of sports and games based on categories is more advisable than a curriculum that chooses a list of countless sports and games with no connection to one another In line with the proposals of the TGfU (23), it is advisable to distribute the wide universe of games and sports by exhaustively grouping them into a finite number of large categories (34).

To organize a homogeneous and exhaustive system of game and sports categories, it is not enough to identify the traits that differentiate some categories from others (20) (specific differences). It is also essential to identify what all the categories have in common with each other (near gender), that is, classification criteria are needed. But TGfU lacks classification criteria to organize and connect its categories. All that glitters in TGfU may not be gold.

In this sense, the classification criteria belonging to internal logic are appropriate in PE because they allow us to understand games and sports internal structures (34). Elements of internal logic are: goal of game, game space, game time, motor-communication and materials (34). Motor praxeology has developed categories using classification criteria the "type of space" and the "type of motor-communication" (35), but has not proposed categories using "type of goal of game" as classification criterion.

The "goal of game" is significant: it has been insistently covered since the 1960s (36), until the present (37). However, the goal of game has not been used in PE to understand games and sports and for its applicability in student learning. The "goal of game" is a treasure to discover in PE.

The aim of the article is to show how to deepen the understanding sports and traditional games from the "goal of game", and to propose its applicability to physical education.

"*Goal of game*" and understanding of sports and traditional games

In the 1960s, the debate on the pre-lusory goal was sparked among formalists, a current within the philosophy of sport that tries to describe and define the concepts "game" and "sport" from the rules (38, 39). The triggering article published in 1967 "What Is a Game?" is signed by Bernard Suits. The debate continues in the present.

Since the 1990s, and after the publication in 1981 of the book "Contribution à un lexique commenté en science de l'action mortice" (40), motor praxeology (science of motor action) has developed concepts, classifications, some research and some proposals of applicability in PE, based on the "motor-goal" (37).

We will focus on the contributions of the formalists and motor praxeology to understand the traits of the "goal of game" concept.

The "goal of game" is an internal component of the game. Suits (36) uses the term "lusory goal" ("lusory", from ludus, "game" in Latin) that means "the goal of game" and refers to a state of affairs to be reached during the game (reaching the goal of game). Suits (41) renamed it "pre-lusory goal" and both terms have come to be used with similar meanings (42).

However (43), describes the differences between the two states of affairs to be achieved. It is the same argument defended by Devine and Lopez-Frias (39): "*Games are goal-directed activities. Each game has two distinct goals: a "lusory" goal and a "prelusory" goal. The pre-lusory goal is a specific state of affairs that players are trying to achieve: putting the ball in the hole in golf, crossing the bar in the high jump, and crossing the line in the marathon. These goals can be achieved prior to the formation of a game. For example, I can put a golf ball in a hole even though no golf game has started, or I can jump over a bar even though no high jump competition is in progress. The lusory goal is to win. This can only be achieved in the context of organized play.*" (digital version).

For motor praxeology, the motor-goal is an element belonging to the internal logic of games and sports (44). Parlebas (34) understands internal logic as the logic of game design (sports rules, traditional game rules) and as the logic of game dynamics (principles of play, decision-making, tactical problems, intentions of play, perceptions, interpretations of the situation of play).

The "goal of game" is the problem to be solved by the players. Torres (45) uses the term "playful problems of the game". For Schell (46) (*p.* 37) "*A game is a problem-solving activity, approached with a playful attitude*". According to Kretchmar (47) (*p.* 12) "*To play a game, we look for (or, as far as necessary, invent) a good problem just so that we can encounter it and try to solve it*". And according to motor praxeology, motor-goal is the demand to be achieved by the participants (44).

The "goal of game"-problems are motor-goals. Parlebas (34) refers to the "motor-task" of sporting games (traditional games, sports), and Lagardera and Lavega (28) say that physical activities and sports are "… *motor-oriented situations, carried out by means of our motor faculties, and with a strictly motor purpose: to score a goal, to pass the bar, to exercise*" (*p.* 50) (respectively in soccer, pole vaulting, and cycling). Rodríguez-Ribas (48) proposed the term "motor-goal" after concluding in his inductive study that all physical activities and sports coincide in that "… *the goal to be achieved is of a motor nature*" (*p.* 31).

Formalists as Suits (49) (*p.* 2) says that sports are "… *competitive events involving a variety of physical human skills (usually in combination with others), in which the superior participant is judged to have exhibited those skills in a superior manner*". And Meier (50) (*p.* 24) says that "… *a game may also properly be called a sport if it possesses the additional characteristic of requiring participants to demonstrate physical dexterity or skill in the achievement of its objective*".

The motor-goal is not only a feature common to all games and sports, it is also a criterion that differentiates (discriminates) what is a motor-game or sport from other games (48, 51, 52). Non-

motor games (board games, chess, e-sports) have no motor-problems to solve.

And finally, *the "goal of game"-problems are the main problems* that players solve during the game dynamics (44).

Summarizing, in traditional games, sports and modified or invented games, the concept "goal of game" refers to a main-motor-problem, described in the rules of the game and that players will try to solve during the game dynamics (see **Figure 1**).

Let's check with an example if there is concordance between the formulation of the concept and reality. The two basketball goals of game are: "*The aim of each team is to score in the opponents' basket and to prevent the other team from scoring* (53)" (art 1.1, *p*. 6). Both are the two main problems that players must solve (article 1.1). Both are motor-problems (getting the ball into the opponents' basket, and preventing them from doing so). Both problems are described in the rules (page 6 and later). Players try to achieve these two goals of game during the game dynamics (playing a basketball game).

The goal of game facilitates the understanding of the internal logic of the game. A short sentence summarizes what the game consists of and summarizes what elements are necessary for the game (in basketball: one ball, two baskets, two opposing teams).

Other examples of goals of game but in traditional games are:

- Dodgeball (two goals of game): hit the ball into the opponents' body, and prevent the opponents from doing so.
- Green light-red light (two goals of game): get to the goal line but avoid moving when "it" turns around, and restart from the starting line if "it" sees you move when it turns around.
- Puss in the corner (two goals of game): to reach a free corner before another player, and to prevent or encourage other players to reach a corner.

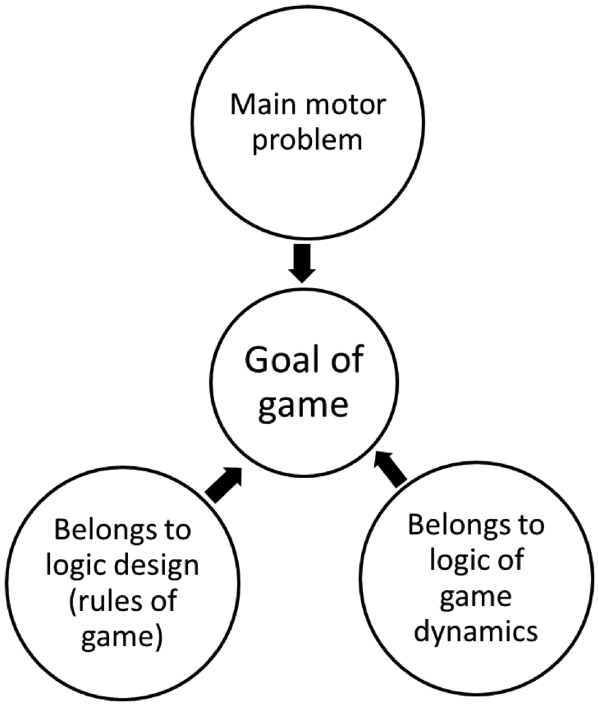

FIGURE 1
Traits that identify the "goal of game" of sports, traditional games and modified games.

Is it possible to use the "goal of game" as a classification criterion for sports and traditional games? The elaboration of a specific classification in PE based on the "goal of game" criterion requires answering the question: "What types of goals of game exist in sports and traditional games?" And specifically, which categories of *main-motor-problems* can be found in the rules of sports and traditional games.

Parlebas (35) states that the goals of game of traditional games and sports included in the so-called "sporting games" are of the space type. "*The spatial goals are the poles around which the acts of the game gravitate*" (*p*. 181). Examples of sporting games are invasion games, net/wall games, tag games, fighting games and running games. The goals of game of the sporting games are synthesized in "to overcome motor-spaces".

Also from motor praxeology, Mateu and Bortoleto (54) (*p*. 133) propose "motor-forms", where "… *the purpose of the motor action: oriented by the production of meaning and by the morphokinetic character*" determine the goals of game of expressive traditional games and aesthetic sports. Examples of this type of sports and traditional games are acrobatic games, juggling games, games of building human towers, games with thematic meanings, games with music and rhythm. The goals of game of motor-expression games are summarized in "to obtain motor-forms".

Formalist sports philosophers (42, 55, 56) distinguish the two large categories of games as well. Kretchmar (57) clarifies Suits (48) by adding that what he calls "performances" is guided by aesthetic factors.

Different goals of game suggest new definitions. Sporting games: "Sports and traditional games whose goals of game imply to overcome motor-spaces". Motor-expression games: "Sports and traditional games whose goals of game imply to obtain motor-forms".

The goal of game allows the understanding of games and sports. The two large categories distribute sports and traditional games of the PE curriculum based on two different goals of game (see **Table 2**).

Deepen the understanding of sports and traditional games. The sporting games in PE

We dedicate this section to deepen the understanding of sports and traditional games. We'll use "goal of game" to apply specifically to sporting games. Deepening the understanding of sports and traditional games that are sporting games using their goals of game requires answering the question: What are the different options "to overcome motor-spaces" in sports and traditional games?

According to the formalist Kretchmar (47) (*p*. 6), the goal game problems include two constituents: "… *gamewriting is a*

TABLE 2 The two large categories of sports and traditional games according to their goals of game, and some examples.

	Categories	
	Sporting Games	Motor-Expression Games
	Goals of game	
	"to overcome motor-spaces"	*"to obtain motor-forms"*
	Examples	
Traditional Games	Traditional sporting games: Puss in the corner, blob tag, capture the flag, ten passes, sitting ball	Expressive traditional games: Castellers, diabolo, jump rope, the mirror, jogo (capoeira), yo-yo
Sports	Basketball, soccer, baseball, kabaddi, golf, tennis, bowling, kumite (karate) dodgeball, volleyball, ultimate	Aesthetics sports: Surfing, figure skating, dance sport, dunk contest, artistic gymnastics

process of manipulating means and ends for purposes of producing 'just right' problems. Frequently, it is a combination of both. Naismith's invention of basketball is a case in point. He problematized the prelusory goal of 'ball-through-basket' by elevating the basket. He also limited permissible means for achieving this state of affairs by prohibiting the use of ladders and by allowing interference by defenders. The combination of the two produced a provocative game problem".

Adding means and conditions to "to overcome motor-spaces" produces new, more concrete problems, i.e., more concrete goals of game. From the motor praxeology, Parlebas (35) (*p.* 177) differentiates in sporting games between space as "*distance to travel*" and space as "*target to achieve*". The distance to travel *"It is the distance a ball or puck is made to travel; It is also, and above all, the distance to travel oneself*". Regarding the target to be achieved, he distinguishes between "*The material targets: almost always fixed, they correspond to conditioned places*" (*p.* 181) and human targets, in which "*The space to be achieved is a dynamic human space…*" (*p.* 182); it is a human target. According to the pointed out possibilities, two components are distinguished for the goals of game "to overcome motor-spaces":

- The arrival component has two options: 1. A target or a goal; 2. Players are the (dynamic) target to achieve.
- The component that will overcome the motor-space to the arrival component has two options: 1.The players themselves will overcome the motor-space to the arrival component; 2. The moving-objects (ball, disc, dart…) used by the players are those that will overcome the motor-space to the arrival component.

Let's act deductively. The combination between the two options of both component (see **Figure 2**) implies a classification of four more specific types of the goal of game "to overcome motor-spaces" (which will be named number 1):

1.1. To overcome motor-spaces (players themselves) to the goal.
1.2. To overcome interpersonal motor-spaces.
1.3. To overcome motor-spaces (moving-objects) to the goal or target.
1.4. To overcome motor-spaces (moving-objects) to players.

Which sports or traditional games contain one or more of these goals of game? For example, basketball and all invasion games contain the goal of game. 1.3. ["To overcome motor-spaces (moving-objects) to the goal or target"]; blob tag and all tag games contain the 1.2. goal of game; baseball and all striking/fielding games contain the goals of game 1.1, 1.3. and 1.4.; paintball and dodgeball contain 1.4.

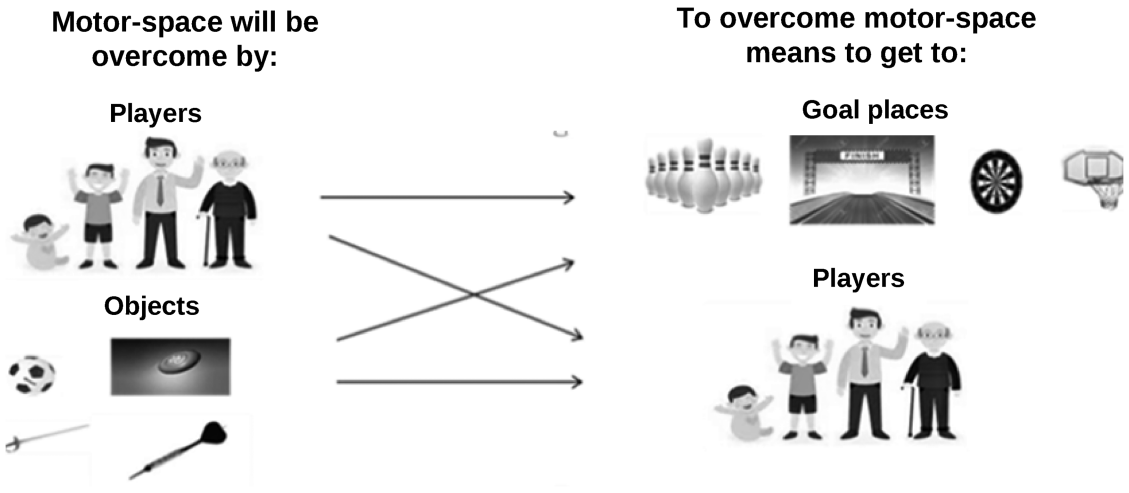

FIGURE 2
Combinations between the two options of the two components based on the goal of game "to overcome motor-spaces" (arrival component and component that overcomes the motor-space to the arrival component).

For further deepening the understanding of traditional games and sports, it will be necessary to deduce their goals of game with a higher concreteness degree. For this purpose, more conditions will be added to the four goals of game. Here are some condition options that can be added:

- The arrival component can be static or be dynamic. For example, the basket in basketball is static, while the human paintball target or the skeet shooting target are in motion.
- The arrival component is usually delimited and localized (e.g., goal, target, bowling, other participants), but there are also variable spaces as a goal, for example, in long jumping or throwing objects away (throwing in athletics).
- Participants may cooperate to get moving-objects or other participants to overcome the motor-space; on the other hand, there are sports and traditional games in which opponents will prevent it.

The following classification of game goals has three concreteness degrees. Some examples of traditional games and sports that contain one or more game goals have been included.

1. "To overcome motor-spaces"

1.1. To overcome motor-spaces (players themselves) to the goal:

1.1.1.1. Perform races/runs (and/or preventing the opponent from doing so). E.g. relays, parkour, striking games (baseball, cricket, rounders), climbing.

1.1.2. Perform height jumping or distance or obstacles jumping (long jump, pole vaulting, ski jumping, bungee jumping).

1.1.3. Occupy spaces (and/or preventing the opponent from doing so) (puss in the corner, musical chairs, king of the mountain).

1.2. To overcome interpersonal motor-spaces:

1.2.1. Hit/touch others and preventing the opponent from doing so. E.g., combative sports (boxing, fencing, taekwondo), tag games (cops and robbers).

1.2.2. Immobilize others and preventing the opponent from doing so (judo, wrestling).

1.2.3. Knock down/excluding others from a space and preventing the opponent from doing so. E.g. judo, sumo wrestling, fencing, traditional wrestling (canarian wrestling).

1.2.4. Group with others (and/or preventing the opponent from doing so). E.g. running to group, Romeo and Juliet.

1.3. To overcome motor-spaces (moving-objects) to the goal or target (examples of moving-objects: ball, disc, puck, javelin):

1.3.1. Put the moving-object to a target or goal and to prevent the opponents from doing so. E.g. invasion games (soccer, basketball), conquest of the flag, kinball, tchoukball, striking games.

1.3.2. Prevent the opponent from forwarding the moving-object to a target or goal. E.g. net/wall games (volley games, tennis games), spikeball.

1.3.3. Throw, shooting or hitting moving-object accurately towards a target. E.g. target games (golf, billiards, bocce, bowling, three-point contest, croquet).

1.3.4. Throw, hitting moving-object at a distance (athletics throws, striking games).

1.3.5. Lifting or dragging objects. (weight lifting).

1.4. To overcome motor-spaces (moving-objects) to players:

1.4.1. Throwing or passing a moving-object to others (and/or preventing the opponent from doing so) E.g., dodgeball, sitting-ball, paintball, ten passes, rondo, striking games, throwing the fresbee to others.

1.4.2. Making a moving-object return (auto-passes, bouncing the ball, boomerang).

This is a classification of goals of game. For example, striking/fielding games contain four different goals of game and, therefore, appear in several categories of goals of game (1.1.1. Performing races/runs; 1.3.1. Get the moving-object to a target; 1.3.4. Throw, hitting moving-object at a distance; 1.4.1 Throw, pass a moving-object to others.

This classification of goals of game has three concreteness degrees, but further concreteness of goal of game can be made to expand the understanding of similar games (or groups of games). For example, starting from the goal of game of invasion sports 1.3.1. "Put the moving-object to a goal and prevent the opponents from doing so", two more concreteness degrees can be specified:

Concreteness level 4 (1.3.1.1): "To put the moving-object into the opponents' goal and to prevent them from doing so", of invasion sports with goal (soccer, field hockey, polo, handball).

Concreteness grade 5 (1.3.1.1.1.1): "To put the ball into the opponents' goal and preventing them from doing so, directing the ball with any part of the body except arms and hands", from soccer [indoor soccer (5 players), soccer-7, soccer-11, jorkyball, beach-soccer].

To correctly express a goal of game requires the infinitive of a verb with the meaning of a problem to be solved, and described with the means contained in the problem (Kretchmar, 2019). For example, the basketball goals of game (two baskets) would be correctly expressed as follows: "to put the ball into the opponents' basket, and to prevent the opponents from putting the ball into our basket".

The goals of game allow a deeper understanding of sporting games from their internal logic (34), that is, from the logic of design (the rules of the game) and from the logic of game dynamics. We have deepened the logic of design of sports and traditional games through goals of game. Is it possible to deepen the understanding of the logic of the game dynamics of sports and traditional games through the goals of game?

As formalist sports philosophers point out, playing a game is to attempt to achieve the goals of game (47, 58, 59). In the same sense, Bayer (59) (*p*. 62) specifies for invasion games that: "… *each player will carry out his action on the playing field, with an intention (and the meaning that is attached to it) that will modify the present situation and it will motivate on the part of the other players (in order to preserve the balance of the system) some intentions that will be articulated among themselves*".

Curiously, the principles of play of invasion games in Bayer (60) (from phenomenology) are the same ones used by Bell and Hopper (61) (from TGfU) to design invasion game learning tasks. We propose a "network of intentions of play" that collects the articulation of levels of intentions of play of the players during the game dynamics, and that are triggered from the goals

of game. The learning tasks are associated to each intention of play. The different levels of intentions of play (level 1, level 2, level 3…) allow us to create tasks for different levels of learning (see **Figure 3**).

Regarding PE, the similarities between the intentions of play of two games suggest coincidental teachings and positive transfers between those games; and the notable differences between their intentions of play suggest a differentiated teaching of those games. And going back to what was stated in the introduction of the article, the transfer of procedures to solve different games is one of the TGfU's working hypotheses (17, 21, 22)'.

Conclusions

"*Goal of game*" refers to a main-motor-problem, described in the rules of the game of sports and traditional games, and that the players will try to solve during game dynamics. For example, the two goals of game of dodgeball are to hit the ball into the opponents' body, and prevent the opponents from doing so; and the two goals of game of basketball are to put the ball into the opponents' basket, and to prevent the opponents from putting the ball into our basket.

Regarding the questions in the article title "how to understand traditional games and sports and how to apply it to physical education", we've have compiled some of the "goal of game" properties taken from the sections of this article, and we propose applicability options in PE for student learning:

- The goal of game is described with a brief phrase, which summarizes what the game consists of and summarizes what elements are necessary for the game. Students can identify the main-motor-problems that they will have to solve in each game (or group of similar games).
- The goal of game is a motor-problem. Students can discriminate between motor games (traditional games and sports) compared to non-motor games (board games, chess, e-sports). Non-motor games have no-motor problems to solve.
- The goal of game serves to classify. Students can compare games by recognizing similarities or differences between main-motor-problems from different games (or a group of games).
- The game dynamics is deduced from the goals of game. Students can solve each main-motor-problem by selecting intentions of play.
- The intentions of play could be transferable. Students can perform similar procedures to solve a main-motor-problem (goal of game) that belongs to two different games (or group of games).

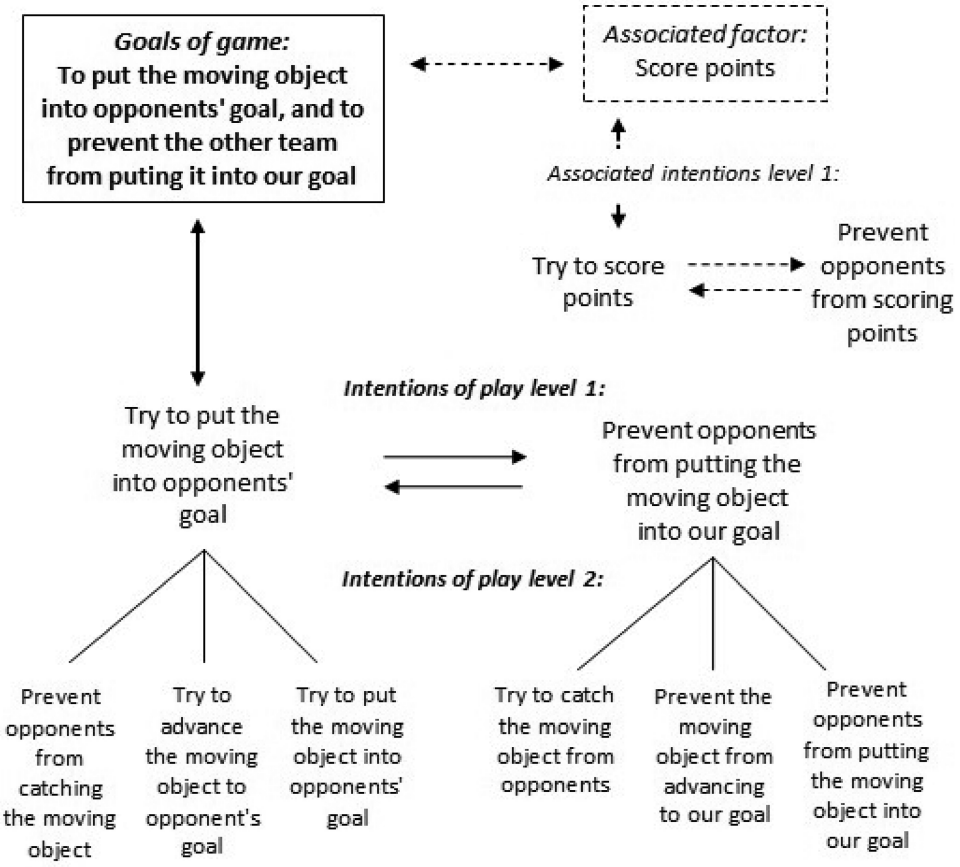

FIGURE 3
Network model of intentions of play of invasion games (according to the principles of play proposed by Bayer (60).

"Goals of game" and "intentions of play" can help PE teachers to plan the program of PE, to design teaching units and sessions, to design modified games and to control the monitoring of student learning.

The "goal of game" is a concept that allows deepening the understanding of sports and traditional games, but it had not been applied to PE before. The authors are aware that what is provided in this article is a first approximation: the goal(d) of game amazes us; maybe PE teachers are curious to continue discovering this wonderful treasure. The "goal of game" can enrich the foundations, research and its applicability from motor praxeology, from TGfU and from the philosophy sport.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author/s.

Author contributions

JPR and JHM contributed to conception and design of the study. PBH and RDD organized the database and performed the analysis. JPR and RDD wrote the first draft of the manuscript. JPR produced the figures and the tables. JHM, JVR, ARJ and PJB wrote sections of the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The effect of nonlinear pedagogy on the acquisition of game skills in a territorial game

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Introduction: Nonlinear Pedagogy (NP), underpinned by Ecological Dynamics, provides a suitable pedagogical approach for practitioners (e.g., Physical Educators, coaches) to encourage exploratory learning that is learner-centered even in Traditional Sporting Games (TSG) that could be represented by invasion or territorial-like games. NP involves the manipulation of constraints which form boundaries for interacting components to self-organize, facilitating the emergence of goal-directed behaviours. Key pedagogical principles relating to representativeness, manipulation of constraints, awareness of focus of attention instructions, task simplification and the functional role of noise can encourage exploratory learning that helps develop 21st century competencies. This is in contrast to a Linear Pedagogy (LP) approach that is more teacher-centered and focuses on repetition in practices to promote movement form consistency in enhancing the acquisition of movement skills. Little is known about the effectivity of NP in the learning and transfer of invasion games. The aims of this study were to: (a) determine the impact of NP on the teaching and learning of an invasion game in the Physical Education (PE) context; (b) examine the transferability of game skills to other games in the same game category (i.e., floorball as a territorial game in this study).

Methods: 224 (between 12 to 13 years old) students underwent a 10-week intervention program to learn to play an invasion game (football) with either a NP or LP approach (i.e., repetitive and prescriptive drills).

Results: Performance outcome data were measured during Pre, Post, Retention, Transfer test 1 (larger playing area) and Transfer test 2 (floorball). Significant improvements in several performance outcome and game play measures in football was observed for the NP condition. Fewer improvements in the same measures were found for the LP condition.

Discussion: Evidence for transfer of learning for NP was not as strong as anticipated although there was still some potential for encouraging transfer of learning. The key findings from this study further challenge the "one-size fits all" philosophy in the teaching of PE. Both LP and NP approaches would have a role to play in supporting teaching and learning which could be context dependent.

KEYWORDS

nonlinear pedagogy, physical education, transfer of learning, traditional sporting games, territorial game

Introduction

A Nonlinear Pedagogy (NP) approach, based on Ecological Dynamics, has been advocated to provide practitioners with key pedagogical principles to support teaching and learning in the PE context (Chow, 2013; Komar et al., 2019; Renshaw and Chow, 2019; Button et al., 2020; Roberts et al., 2020). NP focuses on the inherent complexity involved in motor learning by viewing the individual learner, the task, the environment, and the teacher as key components of a complex interacting system (Chow et al., 2021). These multiple constraints operate on different time scales and interact among one another such that behaviour emerges due to these interacting constraints (Balagué et al., 2019). Specifically, NP is a pedagogical methodology providing principles that govern teaching effectiveness and efficacy in the learning process (Correia et al., 2019; Chow et al., 2022). Pertinent strategies on how to assess performance, how to structure practices, and how best to deliver instructions and provide feedback are particularly relevant (Ovens et al., 2013).

Learners should be given the opportunities to acquire individualized movement solutions based on the learning and performing context (Komar et al., 2019). The interaction of performer, environment and task constraints acknowledges the dynamic influences that each has on learning movement skills (Button et al., 2020). Balagué et al. (2019) further highlighted how task and task constraints, distributed between the performer and the environment, are emergent properties of the environment system. Encapsulating these constraints, practitioners can develop design principles that incorporate representativeness (i.e., *designing practices to mimic performance contexts that encourages the movement behaviours inherent in these contexts*), *manipulation of constraints* (i.e., *changing or accounting for performer, environment and especially task constraints*), *attentional focus* (i.e., *being sensitive to the impact of informational constraints that direct attention to movement form or movement outcome*), *functional variability* (i.e., *infusing practice variability to encourage exploratory behaviour to search for diverse functional solutions*), and the maintenance of pertinent information-movement couplings through *task simplification* (i.e., *reducing the complexity of the task without disrupting the relationship between perception and action for the movement such as increasing the size of object to be kicked or enlarging the playing area to reduce spatial and temporal challenges*; Chow, 2013). Importantly, these design principles, can help practitioners to promote skill transfer across a range of game-related concepts, including invasion of space, which are common to many traditional sporting games.

A growing body of empirical research examines the efficacy of using NP in physical education and sport coaching settings. For example, Lee et al. (2014), provided key insights on how NP can be effective in teaching a modified net-barrier game in a Singapore school setting. Primary school students with no tennis background underwent a learning intervention over several weeks that was taught with either a NP or Linear Pedagogy (LP) approach (i.e., a pedagogical approach with an emphasis on drill and technique to achieve a consistent optimal movement form). Changes in performance were observed at three levels: (1) the individual; (2) in a game setting; (3) in a class setting. Findings showed that the students in the NP condition were just as effective as the LP condition even though there were less explicit prescriptive instructions on movement form in the former condition. These findings provide evidence of *degenerate* behaviours amongst the NP-taught group where many different movement pathways could be recruited to achieve the same outcome (see Seifert et al., 2016).

Miller et al. (2016) also cited the use of NP ideas in enacting a game-centered approach intervention program to determine its effectiveness on improving physical activity and physical education outcomes. In an intervention program that involved 6 × 60 min PE lessons focused on the teaching of Fundamental Movement Skills (FMS) to children, it was found that there were improvements in throwing, catching, decision making and support during game play and in physical activity level during lessons. In another study by Miller et al. (2017), junior netball players were exposed to greater amounts of competition relevant activity, and hence better representativeness in the practices, that reportedly accounted for enhancements to decision making and support skills in game play. For both Miller et al. (2016) and Miller et al. (2017) studies, it was not clear exactly how the design principles in NP were incorporated nor how the interventions supported the control mechanisms for movement behaviours. It should also be noted that a game-centered approach is not specifically a NP approach (see Renshaw et al., 2016). In another study, Pizarro et al. (2019) examined the effects of a NP training program (over 12 training sessions) in the technical-tactical behaviour of youth futsal players. It was found that the players improved to some extent on their passing and dribbling as well as potential for greater ball possession but not in shooting at post intervention. However, this intervention was not undertaken within a PE setting with a small sample size ($N = 8$).

Importantly, there were no specific measurements of transferability of movement skills to other game contexts for the afore-mentioned studies. The issue of transferability is crucial as it highlights the adaptability of movement skills acquired in one context to another similar context. This is akin to learning a game skill in one category of game (e.g., territorial or invasion game) and how those skills may be transferable to another in the same category (e.g., from football to floorball). Such transferability would be important as PE time and resources in schools is typically limited and transferability of such learning across games of the same category could lead to more efficient learning of generic motor skills (Rudd et al., 2020).

The aims of this study were to: (i) determine the impact of NP on teaching and learning of an invasion game in the PE context; and, (ii) examine the transferability of game skills to other games in the same game category. It is predicted that NP would be more effective than LP in the PE context for a series of performance-based measures derived from the football (invasion game) lessons. Specifically, we predict that the NP lessons will develop learner's abilities to play football by increasing the number of successful passes they make, more varied types of passes, longer duration that they remain in possession of the ball and higher number of goals scored. It is also predicted that NP would be more effective in supporting transfer of learning from one game to another within the same game category (i.e., from football to floorball).

Methodology

Participants

A quasi-experimental design was used in which four teachers were selected and their respective classes that were assigned to them were recruited for this study. In total, eight classes of Secondary one level students ($n = 224$) of between 12 to 13 years old at two schools were involved. The two schools were similar in size and social-economic profiles except that one school was a singe gender school (all boys) and the other was a mixed gender school. Classes recruited were then

TABLE 1 Intervention schedule and program overview.

Week	Intervention Lesson	Games-related concept	Skills
1	-	Pre-test (over two sessions)	4v4 football game 4v4 floorball game
1	-	Pre-test (over two sessions)	4v4 football game 4v4 floorball game
2	1	Keeping possession of the ball	Passing, receiving and keeping possession
2	2	Keeping possession of the ball	Passing, receiving, keeping possession and shielding
3	3	Using space to invade	Ball control
3	4	Using space to invade	Moving and turning with the ball
4	5	Creating space to invade	Forward play
4	6	Creating space to invade	Switch play
5	7	Attacking the goal	Beating a player
5	8	Attacking the goal	Shooting
6	9	Stopping the invasion	Tackling
6	10	Stopping the invasion	Marking 1v1 defence
7	11	Regaining possession of the ball	Intercepting
7	12	Denying scoring opportunity	Getting goal-side
8	13	Denying scoring opportunity	Delaying
8	14	Denying space to invade	Defending as a team
9	15	Small-sided games	Revision and collation of skills taught
9	16	Small-sided games	Revision and collation of skills taught
10	-	Post test	4v4 football game
10	-	Post test	4v4 football game
11	-	Retention and Transfer test (1)	Retention and Transfer test (1)-football
11	-	Retention and Transfer test (1)	Retention and Transfer test (1)-football
12	-	Transfer test (2)	Transfer test (2)-Floorball
12	-	Transfer test (2)	Transfer test (2)-Floorball

randomly assigned to a NP condition ($n = 120$) and a LP ($n = 104$) condition.

The same teachers ($n = 4$), with at least 3 years of teaching experience, taught both the NP and LP condition classes to control for the potential impact of teacher effectiveness on the two conditions. The teachers were well-prepared to teach a variety of sports and games using different pedagogical approaches (e.g., Games Concept Approach, Direct Instruction, Guided Discovery and a LP approach that focuses on achieving an expected movement form with an emphasis on drills) but had no prior experience using a NP approach but was subsequently prepared by the research team to teach with an NP approach as part of this study (please refer to information on intervention). The students were not informed if they would be in the NP or LP condition. Written parental consent and participant assent was obtained prior to the start of any data collection. Human ethics approval was granted by the University Institutional Review Board.

Task

Students learnt game skills from an invasion game (football) within a PE context. All students involved in the study underwent a pre-test, intervention (10 weeks), post-test, retention and two transfer tests sessions. All tests were conducted within the student's class groups during scheduled physical education lessons. Please refer to Table 1 for a visualization of the sequence of test and intervention sessions.

During the pre-test, post-test and retention test, students were required to play a small-sided 4v4 game of football with scoring zones at the ends of each length of the field with no goalkeeper. In order to score a goal, students had to move with the ball to the scoring zone or receive a pass from a teammate whilst in the scoring zone. The dimension of play was 21 m in width and 27 m in length. For the transfer test 1, students were tested on a novel context (larger playing field) in relation to the same game that they were taught. The dimension of play was 24 m in width and 31 m in length. The purpose of the transfer test 1 was to provide a platform to examine if students were able to adapt to a different playing area compared to the one that they were familiar with in terms of pitch dimension. In transfer test 2, students were tested using another invasion game (4v4 floorball) to determine transferability of learning (from football to floorball). The dimension of play was 21 m in width and 27 m in length. Floorball is an invasion game that is included in the Singapore PE syllabus and like football, floorball is played by two competing teams. The game is akin to a field hockey game where players manipulate a plastic floorball stick (similar to a field hockey stick) with a plastic ball (similar in size to a tennis ball) as they attempt to score a goal (similar in size to ice-hockey goal). See Figure 1 for an illustration of the set-up for the test sessions.

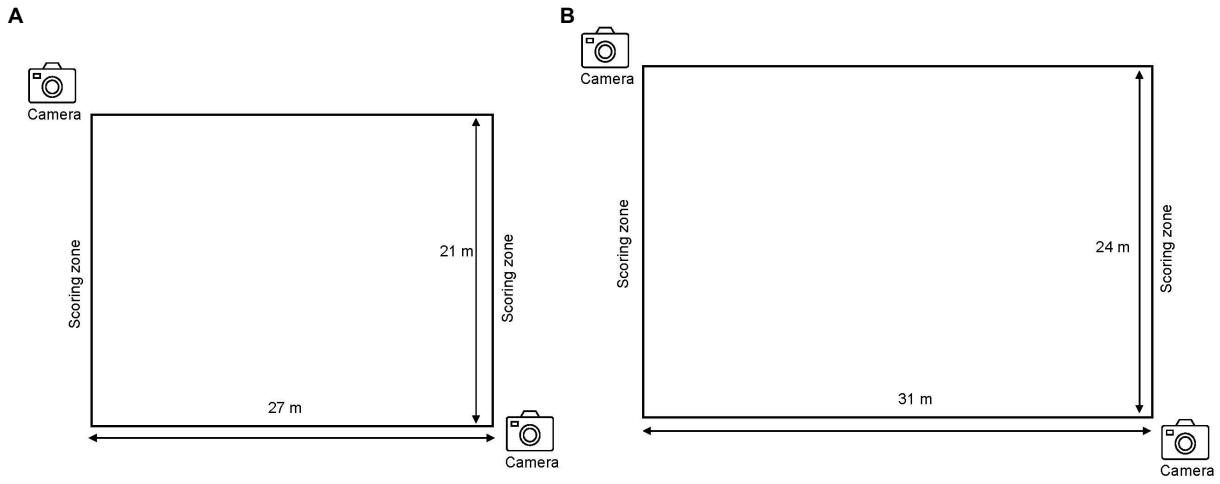

FIGURE 1
Illustration of the set-up for **(A)** pre-test, posttest and retention test sessions and **(B)** transfer test 1.

Throughout the different test sessions, students were kept to the same teams when possible and each team played against the same opposition. However, in instances where students could not attend the test sessions, in order to maintain consistency between sessions, it was ensured that no more than two students could be replaced per game. Students were replaced by another student of the same gender from the same class.

Intervention

Students in the NP condition were presented with lessons that were underpinned by NP design principles. For example, NP learning activities incorporated many representative designs (e.g., small-sided games that provides relevant perceptual information), use of exploratory cues (e.g., analogies to encourage exploration of different movement solutions), infusing variability in practices (e.g., using difference ball sizes and playing dimensions in terms of space), a focus on simplifying task (e.g., modified rules and activities to encourage success). LP lessons focused on repetition of practices to acquire consistency in the expected movement solutions (e.g., kicking a ball based on prescriptive instructions on the form) and using standard sized equipment and playing areas to ensure practice specificity of the expected movement solutions. Examples of LP and NP lesson plans for the first week can be found in Supplementary Table 1. All intervention lessons were conducted during the students' regular PE class times, which occurred during two 1-h slots every week.

Prior to the intervention lessons being delivered, the physical education teachers received 1-h weekly professional development sessions with the research team to ensure that the lessons on invasion games were delivered according to the lesson plans set out for the respective pedagogical conditions. Details of weekly lesson objectives can be found in Table 1. In addition, the lessons conducted by each teacher were supported by a research assistant in terms of administering and video-recording the lessons taught. A 2-h workshop on key pedagogical principles for both NP and LP was also delivered by the first author for the four teachers prior to data collection.

Evaluation of the intervention fidelity was determined by an external reviewer, independent to the study but familiar with PE pedagogy (including NP and LP), to ensure that the instructions undertaken by the teachers were in line with the intervention lesson plans. Two PE lessons per teacher per condition (e.g., 4 lessons from each teacher) were randomly selected to be observed and rated against a series of descriptors to confirm that the teachers did indeed abide to the planned lessons for both NP and LP conditions. Coding of the observed lessons by the research assistant (fourth author) showed a 78.6 and 82.1% lesson agreement for the NP and LP lessons, respectively.

Data analysis

Performance outcome (football)

All test sessions (pre, post, retention, transfer test 1 and transfer test 2) were recorded using digital video cameras placed at two locations.

The research assistant coded the game performance outcomes. Performance outcome definitions and game coding details are outlined in Table 2. The entire game period was split into 'runs' which is defined as a period where the ball is in play for a minimum of 3 s. Performance outcome variables (e.g., passes, possession time and number of goals etc.) were then coded for each run. Table 3 provides coding details for the number of types of passes. Twenty percent of all test session videos (10% of LP and 10% of NP groups) were recoded and rated again (see Miller et al., 2016) and a percent agreement reliability test (number of agreements/number of agreements + number of disagreements) was used to assess the intra-rater reliability (Blomqvist et al., 2005). Reliability of game coding was found to be at 85% for NP and 86% for LP.

Before inferential statistics were performed, preliminary assumption testing was conducted on all variables. Specifically, checks were conducted for multivariate normality using the Shapiro–Wilk test of normality, univariate and multivariate outliers using the Mahalanobis distance, homogeneity of variance–covariance matrices through the Box's M Test of Equality of Covariance Matrices and multicollinearity. In instances where the assumption of normality was violated, Pillai's Trace was used to evaluate the multivariate significance of the principal effects. Outliers found through the use of Mahalanobis distance were removed from the analysis. In the case where homogeneity of

TABLE 2 Performance outcome definitions and game coding details.

Action	Definition
Pass	Successful pass When a teammate kicks the ball and the ball is received by his/her teammate Unsuccessful pass Opponent intercepts, gets possession of the ball or the ball goes out of play
Consecutive passes	Successful consecutive pass Team maintains possession of the ball when two or more continuous passes occur between teammates Unsuccessful consecutive pass Opponent intercepts, gets possession of the ball or the ball goes out of play
Goal	Successful goal Ball is brought into the scoring zone or the ball stopped within the scoring zone by a teammate after receiving a pass Unsuccessful goal Opponent intercepts, gets possession of the ball or the ball goes out of play
Possession time	Possession time starts from the moment the team is in possession of the ball to the time when the ball was intercepted, interrupted by the other team or is kicked or caught out of bounds
Turnover	Point in which the possession switches from one team to another
Runs	Period in which the ball is in play for more than 3 s

covariance was violated, Pillai's Trace was used instead of Wilk's Lambda to evaluate the multivariate significance of the principal effects and the interactions.

Multivariate analyses (MANOVA) 2 (Group: NP and LP) X 4 (Session: Pre-test, Post-test, Retention test, Transfer test 1) were conducted to determine differences within groups and between pedagogical conditions for performance outcomes (e.g., mean successful passes, number of consecutive passes, number of types of passes, total possession time and number of goals). Separate MANOVAs were conducted for performance outcome, game play behaviours during runs. It was insightful to explore the possible differences in game dynamics that could surface during a run as it is an important feature of invasion games. A mixed factorial ANOVA was conducted for the variable of turnover counts.

Transfer of learning from football to floorball

A 2 (Group: NP and LP) X 2 (Pre-test and Transfer test 2) MANOVA was used to determine the differences within and between groups for performance outcomes (e.g., mean successful passes, total number of goals and total possession time).

All statistical analyses were conducted using IBM SPSS Statistics 26.0 at significance level of $p < 0.05$ and effect size was calculated using partial eta squared η_p^2. In instances when the MANOVA detected statistically significant differences, univariate ANOVAs with Bonferroni post-hoc test was conducted on the simple effects of interest.

TABLE 3 Coding for number of types of passes.

Type	Type definition	Contact	Flight/ Grounded	Outcome
Push pass	Pushing action on the ball	Inside foot	Flight	Into space
Hard pass (pass with more power)	Pass with power	Instep/Lace portion	Flight (low)	Direct
Chip pass	Ball kicked from underneath	Toe	Grounded	Direct to chest
Toe flick	Light touch/ flicking action with the toe	Ankle		Direct to knee
Toe pass	Pass with toe (like a toe poke)	Sole		
Back pass	Passing the ball backwards	Outside foot		
Sweep pass	Sweeping action towards the ball rather than a simple push	Back of foot		
Drag pass	Contact/ Dragging the ball between the bottom of the foot and the ground	Knee		
Off ground passes	Any passes that involve contact with the ball above ground			

Results

Performance outcome

Significant improvements in performance outcome in football (e.g., mean successful passes and number of types of passes) were observed for the NP groups. See Table 4 for a summary of results for performance outcome across sessions.

There were significant main effects of Group [Pillai's Trace = 0.061, $F(3, 190) = 4.10$, $p = 0.008$] and Session [Pillai's Trace = 0.183, $F(9, 576) = 4.15$, $p = <0.001$] on the combined dependent variables of mean successful passes, number of consecutive passes, number of types of passes, total possession time and total number of goals. There was no significant interaction effect between Group x Session [Pillai's Trace = 0.062, $F(9, 576) = 1.35$, $p = 0.210$]. Between Sessions, follow-up univariate test found a significant difference for mean successful passes, $F(3, 192) = 6.15$, $p = 0.001$, $\eta_p^2 = 0.088$. The NP group experienced more

TABLE 4 Summary of results across sessions.

Performance outcome		
Type	NP	LP
Mean successful passes	More mean successful passes during post-test and retention test compared to pre-test	No changes across sessions
Number of types of passes	Higher number of types of passes during post-test, retention test and transfer test compared to pre-test	No changes across sessions
Total possession time	Higher possession time from post-test compared to pre-test	Higher possession time from post-test, retention test and transfer test 1 compared to pre-test
Number of consecutive passes	No changes across sessions	No changes across sessions
Total number of goals	No changes across sessions	No changes across sessions
Turnover counts	Higher turnover count during post-test compared to pre-test	Higher turnover during transfer test 1 compared to pre-test
Transfer of learning from football to floorball		
Type	NP	LP
Mean successful passes	More mean successful passes at transfer test 2 compared to pre-test	No changes across sessions
Total possession time	Higher possession time at transfer test 2 compared to pre-test	No changes across sessions
Total number of goals	No changes across sessions	Higher total number of goals at transfer test 2 compared to pre-test

successful passes during post (13.21 ± 5.28, $p = 0.003$) and retention test (13.00 ± 5.25, $p = 0.006$) as compared to pre-test (8.50 ± 4.77), however there were no significant changes for the LP group across test sessions.

Separate univariate ANOVAs revealed significant main effects of Group [$F(1, 184) = 11.438$, $p = 0.001$, $\eta_p^2 = 0.059$] and Session [$F(3, 184) = 5.134$, $p = 0.002$, $\eta_p^2 = 0.077$] on the number of types of passes (see Figure 2). Specifically, only NP groups experienced a higher number of types of passes during post-test (9.18 ± 3.62; $p < 0.001$), retention test (9.25 ± 3.36; $p < 0.001$) and transfer test 1(8.64 ± 3.30; $p = 0.005$) from pre-test (5.86 ± 2.37). No significant changes were found for LP across sessions. Between Groups, NP had more types of passes as compared to LP during post-test ($p = 0.005$) and at transfer test 1 ($p = 0.028$).

A significant univariate main effect of Session was also obtained for total possession time, $F(3, 192) = 11.47$, $p < 0.001$, $\eta_p^2 = 0.152$. NP group showed higher possession time from post-test (87693.21 ± 27410.44, $p = 0.010$) to pre-test (63113.57 ± 27341.91). LP group experienced significantly higher possession time from post (90642.27 ± 32696.68, $p = 0.001$), retention (97014.09 ± 31644.32, $p < 0.001$) and transfer test 1 (89235.45 ± 33310.86, $p = 0.002$) to pre-test (57183.64 ± 24105.14). There was no main effect of Group, $F(1, 192) = 1.68$, $p = 0.197$, $\eta_p^2 = 0.009$.

Univariate ANOVAs for number of consecutive passes and total number of goals showed that there was no significant main effects for Session and Group.

For Turnover counts (i.e., change in possession between teams) there were significant main effects of Session [$F(3, 100) = 6.68$, $p < 0.001$] and Group [$F(1, 100) = 6.99$, $p = 0.010$], however there was no significant interaction effect. *Post hoc* test revealed that between Sessions, NP groups has a significantly higher turnover count ($p = 0.048$) during post-test (26.13 ± 11.85) as compared to pre-test (17.00 ± 7.54), whereas this significant difference was found ($p = 0.001$) for LP group at transfer test 1 (25.75 ± 11.89) from pre-test (11.08 ± 7.23).

Transfer of learning from football to floorball—Performance outcome

Significant improvements in performance outcome during the transfer of learning to floorball (e.g., mean successful passes and total possession time) were observed for the NP groups. There was a significant main effect Session [Pillai's Trace = 0.173, $F(3, 78) = 5.42$, $p = 0.002$] on the combined dependent variables of number of passes, number of goals and possession time. There was no significant main effect of Group and no significant interaction effect.

Univariate tests revealed that for mean successful passes (see Figure 3), there was a main effect of Session, $F(1, 80) = 7.08$, $p = 0.009$, $\eta_p^2 = 0.081$. *Post hoc* analysis showed that the mean successful passes for NP group was significantly higher at transfer test 2 (9.83 ± 4.70, $p = 0.005$) from pre-test (6.58 ± 3.53). LP group did not experience significant changes between Sessions ($p = 0.309$). There was no significant interaction effect, indicating that at transfer test 2, mean number of passes was not different between the two groups ($p > 0.05$).

With regards to the total number of goals, a main effect was found for Sessions, $F(1, 80) = 9.11$, $p = 0.003$, $\eta_p^2 = 0.102$. Between Sessions, the LP group had higher total number of goals during Transfer test 2 (2.44 ± 2.09, $p = 0.011$) from pre-test (0.89 ± 1.18). NP group did not experience any statistical change across Sessions ($p > 0.05$). There was no Group and interaction effect as well ($p > 0.05$).

A main effect of Session was also found for total possession time, $F(1, 80) = 9.12$, $p = 0.003$, $\eta_p^2 = 0.102$. *Post hoc* analysis showed that total possession time was significantly different between sessions only for NP ($p = 0.003$) from pre (80074.25 ± 27699.09) to transfer test 2 (104020.92 ± 28546.13). Similarly, there was no Group and interaction effect ($p > 0.05$).

Discussion

The aims of this study were to: (i) determine the impact of NP on teaching and learning of an invasion game in the PE context; and, (ii) examine the transferability of game skills to other games in the same game category (i.e., football to floorball). Findings from this study have added new knowledge to the impact of NP on the teaching, learning and transfer of invasion games. Significant improvements in several performance outcome and game play measures in football was observed for the NP condition. Fewer improvements in the same measures were found for the LP condition. Specifically, NP demonstrated more successful passes and number of types of passes between sessions. LP demonstrated higher possession time from post, retention and transfer test 1 compared to pre-test, while there was only a significant difference for NP between pre and post-test sessions. NP also had higher turnover

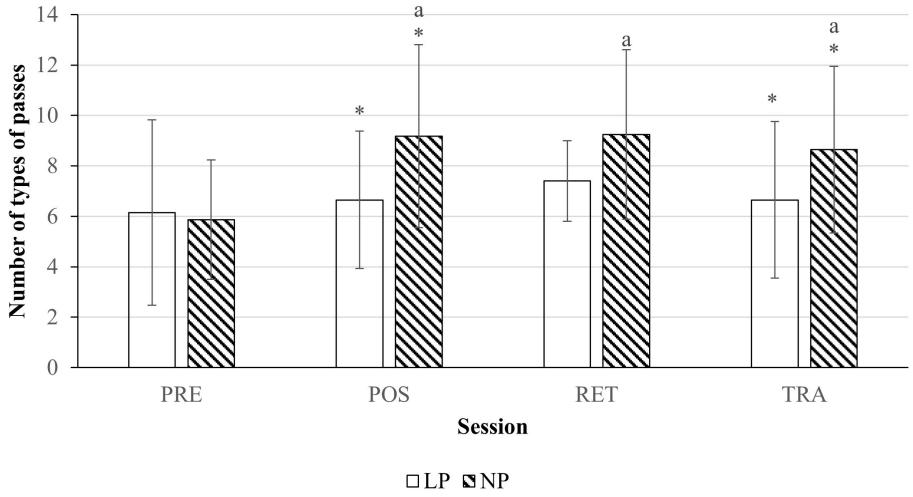

FIGURE 2
Number of types of passes. (*) Indicates significant differences between groups (p <0.05) and (a) indicates significant differences in comparison to the pre-test (p <0.05). The x-axis shows pre-test (PRE), post-test (POS), retention test (RET) and transfer test (TRA) sessions. Transparent bar represents LP condition and shaded bar represents NP condition.

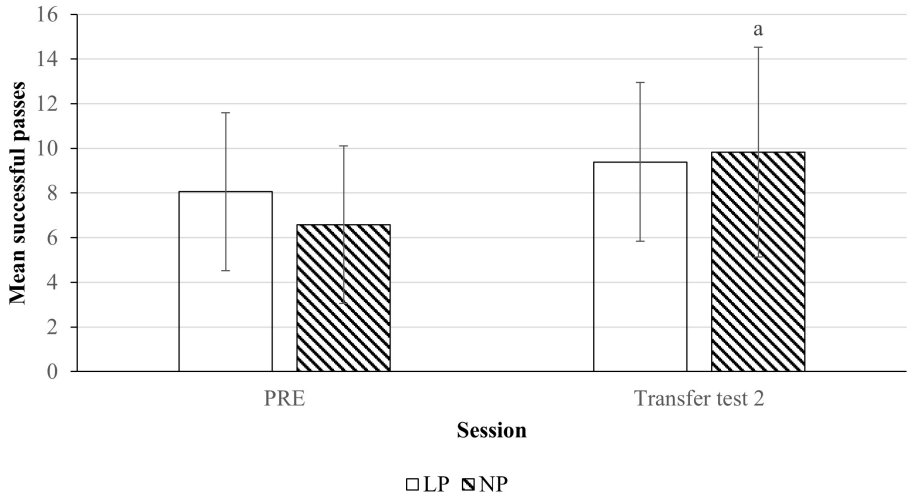

FIGURE 3
Mean successful passes for floorball between pre and transfer test 2 sessions. (a) Indicates significant differences between Pre and Transfer test 2 (p <0.05). The x-axis shows pre-test (PRE), transfer test 2 sessions. Transparent bar represents LP condition and shaded bar represents NP conditions.

count during post-test as compared to pre-test whereas LP showed difference at transfer test 1 to pre-test. With regards to transfer of learning to a floorball game, NP had higher mean successful passes but LP had higher total number of goals at transfer test 2 from pre-test, respectively. Total possession time was significantly higher only for NP from transfer test 2 to pre-test. Nevertheless, there was less clarity on the benefits for either NP or LP conditions for transfer from football to floorball.

One important insight from these results was confirmation that key pedagogical principles for NP can be effective in PE settings. A larger range of functional movement behaviours (e.g., greater number of different types of passes) observed in NP classes further affirmed that an exploratory pedagogical approach was as good as a prescriptive pedagogical approach (LP) to teaching invasion games with reference to enhancing performance outcomes. This is especially insightful as it suggests that a NP approach to teaching game skills allows students to explore their perceptual motor landscape more effectively to acquire a greater variety of movement behaviours, harnessing the degenerate features of the human movement system more actively (Button et al., 2020). This is in contrast to a LP approach where the students are more likely to adhere to the prescribed movement cues and limit exploration of other possible movement solutions. In terms of practical implications, the NP approach could promote a broader range of passing solutions in actual game performance contexts. Specifically, the inclusion of representative small-sided games in NP approach could support students to acquire higher potential of functional diversity such that they can better adapt to different game and environmental constraints (Hristovski and Balagúe, 2020). A greater repertoire of passing solutions will intuitively provide greater opportunities to execute more functional play outcomes as compared to a context where students are only using a limited array of passing options as prescribed in the LP lessons. This could explain the higher number of successful passes found in the NP condition. Such a variety of passing options could indeed lead to greater

effectiveness to achieve the task goal present in game situations. This in turn can be manifested in greater observed adaptability on the part of the learner which is a key in supporting transfer of learning. Through NP, teachers can manipulate task constraints (e.g., design of practices and use of appropriate informational constraints) to encourage learners to search, explore and exploit different movement solutions (Roberts et al., 2019; Button et al., 2020). These exploratory behaviours are important because they help learners to become attuned to information that matches environmental properties and the learner's own capabilities to move (Hacques et al., 2020). Undoubtedly, from a specificity of practice perspective, one would expect that multiple solutions should be practiced if flexibility in using multiple solutions is the desired outcome of learning (Ranganathan et al., 2020).

It was also noted that while both NP and LP conditions could cope equally well when they had to play on a larger pitch size (transfer test 1), a greater advantage resided in the NP classes. The transfer to a novel context in terms of different pitch dimensions do offer opportunities for students to adapt their learning. Skill adaptation is a key learning outcome in PE since lesson time for NP, which focuses on exploratory learning, is likely to be a premium within a school curriculum (Chow, 2013). Moving forward, other possibilities in terms of transfer test within the same game (i.e., football in this case) may be undertaken to examine how NP and LP conditions could possibly elicit different responses. For example, the addition of goals or changes in number of players would be alternatives in examining adaptability within the game of football. This is particularly pertinent when consideration is to be given to how the impact of an NP approach based on ecological dynamics can be assessed. Indeed, skill transfer and learning should be seen as an adaptive process to support skill and talent development (Seifert et al., 2018).

While the performance outcomes were promising for a NP approach to teaching football, the results on transfer across different games (from football to floorball) in the same game category did not emerge as strongly as anticipated for NP. Note that NP demonstrated more effectiveness for *number of successful passes*, and *total possession time*, but LP had the advantage for *total number of goals*. Nevertheless, one limitation of the work is the use of the current variables to examine impact of NP or LP approach to invasion games. It should be recognised that especially in invasion games, the behaviour of teams and players are closely connected to how fellow teammates and opponents play. There is inherent limitation to discrete performance outcome variables in such a context where cooperation and opposition co-exist simultaneously in space and time.

It is also possible that perhaps the transfer test of floorball could be too different from the game of football in terms of game play dynamics and the effect of transfer did not manifest itself as significantly. It may signal that the gap between the intrinsic dynamics of the students (i.e., the inherent movement repertoire of the students) is probably too big with reference to what is needed for the transfer task, which is in this case the floorball task. Specifically, the task dynamics of the floorball task could differ significantly from the task dynamics of the football task (i.e., the need to manipulate a stick in floorball could be a transfer scenario that is distinct from football even though both are territorial games). Thus, while the intention is to consider the possibility of transfer, it is critical to examine the dynamics of the task. Transfer may be potentially challenging even though the games could be in the same game category when the task dynamics differ significantly. This lends itself to the discussion on general or specific transfer of learning and the role of specifying and non-specifying information. Specific transfer refers to a context where the practice closely relates to how the movement would be performed while general transfer refers to practices where the movement is less related to how it would actually be executed in a performance context but provides some approximation of its execution. In ecological dynamics, specifying information is functionally relevant for regulating human behaviours and is deemed to be more useful for specific transfer contexts while non-specifying information is more meaningful for general transfer contexts (Chow et al., 2020). The information available in the football context (e.g., ball in relation to use of feet for control) could be more specifying for a transfer to a game that closely resembles football (e.g., indoor football like futsal) rather than floorball in this context. Maybe larger time scales (i.e., months of training) or more tests could also be needed to evaluate the transfer of football to floorball as well.

Nevertheless, the key findings from this study further challenge the "one-size fits all" philosophy held by many PE teachers (see Lee et al., 2014). Practitioners should see themselves as co-designers of practices and as facilitators of learning (Correia et al., 2019; Roberts et al., 2019). Importantly, practitioners should consider alternate assessment rubrics rather than those focused solely on a 'correct' movement form expected of all students when designing practices and lessons. While NP may be perceived to be more time-consuming to enact and perhaps less 'control' in how students would explore movement solutions, the benefits come in the form of the learning experiences (Chow, 2013).

In this study, NP was observed to be as good as LP or better in relation to performance outcomes. This is encouraging as one might expect that experiences of the two approaches would differ markedly where NP is more learner-centered in encouraging the learner to solve movement problems themselves and self-organize under constraint. Nevertheless, the use of LP could still be relevant as in reality, teachers are probably more likely to use some form of hybrid approach that incorporates elements of both NP and LP approaches. The difference could be the extent to which NP or LP actually featured in some of these practice sessions (see Supplementary Table 1). The polarization of using either NP and LP in this current study is intentionally structured and future work could involve a mixed pedagogy that has a blend of both NP and LP to examine its effects on learning in TSG. Ideas pertaining to LP where stabilization of an optimal pattern and repetition may work well for some situations cannot be discounted (i.e., for safety reasons, or if the learner is too nervous to explore). But more often than not, striving for exploration and adaptability could work even more effectively.

Moving ahead, key 21st century competencies such as creativity, cooperative-competitive intelligence, and team-work should be assessed in the future (Hristovski and Balagúe, 2020). There could also be better ways to examine if and how learning occurs within the context of team games in TSG especially in relation to adaptation. Measuring performance outcome is one of many possible indicators of learning but understanding changes in team dynamics in small-sided games would also be insightful (e.g., how teams adapt to one another with NP, LP or even a mixed approach). Undoubtedly, future work on examining NP can also have further implication on Teacher Education and Professional Development programs pertaining to PE. Pedagogical principles pertaining to NP can be relevant for revising and enhancing PE curriculum in schools (Chow et al., 2021). Notably, there is potential to use NP to encourage teaching and learning to be student-centered and focusing on optimizing individual movement competencies (Chow et al., 2021). Practitioners could incorporate key pedagogical principles of NP in the delivery of content and teaching within school-based PE settings for TSG to help develop greater creativity and involvement among students. Translation of the findings and implications on practice can also be examined in future studies.

Data availability statement

The datasets presented in this article are not readily available because only anonymized data may be available on request. Requests to access the datasets should be directed to jiayi.chow@nie.edu.sg.

Ethics statement

The studies involving human participants were reviewed and approved by Nanyang Technological University Institutional Review Board (IRB-2015-02-029). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

JC, CB, and BT conceptualized and designed the study. CC collected the data. LM and CC performed the data analysis. JC and CC wrote most of the paper with LM and CB providing valuable input. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1077065/full#supplementary-material

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"Where was this when I was in Physical Education?" Physical literacy enriched pedagogy in a quality physical education context

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Introduction: In recent years, there has been a call to restructure physical education (PE) practices and outcomes. A physical literacy enriched pedagogy approach would support this change by more intentional design of lesson planning that includes concurrent development of competence & confidence and inclusion of students of all levels of ability, leading to holistic development of the student. Despite this potential, there is little research to date that outlines PE pedagogical practices with physical literacy as a foundation. The purpose was to explore pedagogical practices and perspectives from elementary PE teachers through a physical literacy enriched pedagogy lens in a high-quality PE context.
Methods: One-on-one semi-structured interviews were conducted with a convenience sample of elementary PE teachers within one school division. Interviews with all participants focused on questions related to PE and physical literacy. Thematic analysis was used to analyze the data collected from the audio-recorded interviews.
Results: Four themes were generated based on the semi-structured interviews from six elementary PE teachers from one school division. The results identified key physical literacy enriched pedagogical practices based on four themes: supporting a holistic PE experience based upon physical literacy as an outcome; movement within and beyond PE; inclusive and individualized experiences; and physical literacy practices bringing the school community together. The findings were then connected to the physical literacy cycle and UNESCO components of quality PE.
Conclusions: All participants spoke to how their pedagogy focused on the holistic development and inclusion of their students based upon activation of various feedback pathways of the physical literacy cycle. The themes that emerged and subsequent insight gained from teachers went beyond existing physical literacy cycles, in particular by discussing development of students from cognitive, affective, social and creative (problem solving) perspectives, supporting an expansion to the existing physical literacy cycle as presented.

KEYWORDS
schools, children and youth, teachers, students, physical activity

1. Introduction

Despite extensive knowledge on the importance of movement, and the negative downstream effects of insufficient activity (1), few sustainable solutions exist in today's movement suppressed culture, which has only been further exacerbated as a result of the COVID-19 pandemic (2). With a physical activity approach focused on health outcomes (i.e., meet the guidelines to avoid non-communicable disease), little attention is directed at why we move, and the motivational structures associated with this. Though there exist

various approaches to increase physical activity, few long-term successes (limited to efficacy) can be demonstrated (3, 4), and part of this failure may be due to a focus on instrumental valuation as opposed to intrinsic valuation of movement (5). Shifting away from the dehumanizing physical activity promotion strategies to support intrinsic valuation of movement (6), as exemplified in physical literacy through concurrent development of competence and psychological characteristics such as confidence and motivation (7), may be a way to support more sustainable behaviour change. One of the contexts in which this shift in thinking may be particularly impactful is in schools where positive movement experiences can be supported (8, 9).

As identified by the United Nations Educational, Scientific and Cultural Organization (UNESCO), physical education (PE) is critical to school community health and physical activity (10, 11). Specifically emphasized by UNESCO is the idea of quality physical education (QPE), of which the outcome is physical literacy (10, 11). In recent years, there has been a call to restructure PE practices and outcomes (12–14) which necessarily includes a disruption of the traditional sport-based PE model (15). Many PE curricula now include statements around physical literacy (e.g., 16), but it is also critical to provide effective teacher training to support holistic physical literacy enriched approaches (17). Meaningful PE is a requisite part of QPE (18), and QPE necessarily involves the adoption of a physical literacy informed and enriched pedagogy. Physical literacy enriched pedagogy has broad applicability to movement contexts, resulting in more intentional design of lesson planning that includes confidence building [e.g., development of a sense of pride (19) and opportunities to exercise agency (20, 21)] through the construction of positive challenge (22). A physical literacy enriched approach would also allow for a greater level of inclusion in lesson plans, increased capacity to retain and progress participants, and a shift away from a solely technical movement focus to a holistic approach that includes psychological and social aspects related to a child's movement experience (23). Physical literacy enriched pedagogy in the PE context may provide a unique way to activate the physical literacy cycle for all students which would necessarily subsume non-linear pedagogy (24) leading teachers to be deliberate in the way they deliver instruction and set up their space for learning.

Although activation of the physical literacy cycle in the PE context is critical, to date there is little evidence that outlines the pedagogical practices using physical literacy as a foundation, that would support a holistic approach to fostering movement potential for all students. Therefore, the purpose was to explore pedagogical practices and perspectives from elementary PE teachers through a physical literacy enriched pedagogy lens in a high-quality PE context.

2. Methods

2.1. Study design

A qualitative interpretive description study design (25) was employed to gain a better understanding of PE teacher pedagogical practices. This approach is ideal in the school context as it provides a research process that supports enacting meaningful results within applied disciplines (25). The primary method of data collection was one-on-one semi-structured interviews. Ethical approval was obtained from the University of Manitoba's Health Research Ethics Board (H2021:401) and divisional approval was also granted.

2.2. Context and participants

The PE context in Manitoba is unique relative to other places in Canada and internationally as there is mandatory PE for kindergarten through grade 12, with PE 3–5 days per week (30–60 min/class), and nearly all teachers delivering the PE curriculum are specialists. Class sizes are small and nominally set to 25 with a range of 20–30 students per class. Since 2009, province-wide PE has largely been focused on the development of a child's physical and health literacy.

The elementary schools from a single school division were identified as a convenience sample based on the conditions and longstanding quality initiatives that have been undertaken to foster quality PE. These initiatives and conditions include; for over a decade, an average of 4 full days per year of PE and physical literacy focused professional development for PE teachers; the existence of an active community of practice using smartphone applications (e.g., WhatsApp, Instagram) and cloud-based document sharing for progressions; the existence of a full time PE/HE coordinator that provides support for the 15 elementary schools in this division including acting as an advocate to the school board and trustees for funding, grant writing, liaison to other school staff and administrators.

Six elementary (K-5) school PE specialists within this division were recruited based on a general recruitment email sent to the 15 elementary schools in the division. The PE classes were nominally 38 min in duration with a frequency of 4–5 classes per week. All participants have previously attended physical literacy focused professional development, and three attended the circus instructor training program at the National Circus School. The six participating teachers (5 male, 1 female) ranged from 2 years to 15+ years of teaching experience, all teaching kindergarten through grade 5 PE, within a school division serving low to middle socioeconomic families.

2.3. Procedure

PE teachers were invited to discuss their experiences teaching PE in an audio-recorded interview lasting 45–60 min. Interviews with all participants followed a semi-structured interview format, focusing on questions related to physical education and physical literacy. The semi-structured interview guide was developed through consultation with a co-author and with the PE/HE coordinator in the division. This co-production process is referred to as "equitable and experientially informed research" by Smith et al. (26). Interviews took place virtually in the Spring of

2022. Upon completion of the interviews, the first author transcribed all audio recordings verbatim. Participant quotations will be included in the results section and include participant pseudonyms.

2.4. Analysis

Data analysis followed a six-step thematic analysis process which included familiarization with the data, generating codes, identifying themes, reviewing themes, defining themes, and creating the report of results (27, 28). Codes were generated for each transcript, and the themes were then cross-checked by a co-author (i.e., critical friend), as suggested by Gibbs (29) to confirm the codes were generally agreed upon by another researcher. Data trustworthiness was established based on aspects of credibility, transferability, and dependability (30).

Upon scrutiny of the transcribed data, there was consensus by both authors that the thematic elements and related quotations could be readily attached to the feedback pathways of the physical literacy cycle [shown in **Figure 1** and derived from Stuckey et al. (31)] especially since it is a desired outcome of QPE (11). Further, we connected the findings to components of QPE, as outlined by the UNESCO statement: "Quality physical education is distinct from physical education. The main differences relate to ***frequency, variety, inclusivity*** and ***value content***. Quality physical education is about ***peer-led learning*** and ***rounded skill development*** which can enhance educational and employability outcomes" (11).

3. Results

Four major themes were generated to summarize the participants' pedagogical practices: (1) *Supporting a holistic PE experience based upon physical literacy as an outcome*, (2) *Movement within and beyond PE*, (3) *Inclusive and individualized experiences*, and (4) *Physical literacy practices bringing the school community together*. Further, quotations within each theme were attached to activation of one (or more) of the feedback pathways of an evolved physical literacy cycle shown in **Figure 1**: (1) competence-confidence; (2) motivation-active participation; (3) fun-enjoyment-pleasure; (4) connectedness-relatedness; (5) creativity-agency; or labelled as (6) being generally related to the physical literacy cycle (31) or generating a positive movement experience (32). Quotes were also labelled by theme number (T) and quote number (Q) within that theme for linkages to QPE components.

3.1. Theme one—supporting a holistic PE experience based upon physical literacy as an outcome

There was strong support for physical literacy enriched approaches among all teachers, and aspects of physical literacy were identified by all participants as the goal of their PE class, as discussed by Lenny:

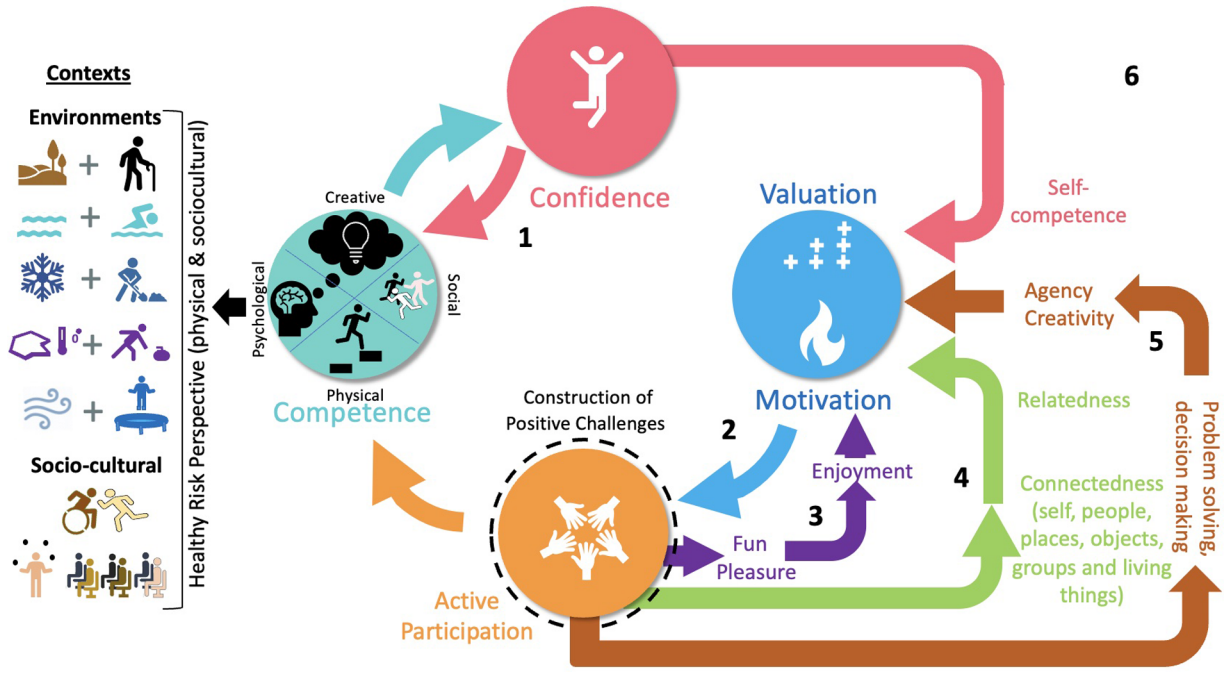

FIGURE 1
Enhanced physical literacy cycle, modified from Stuckey et al. (31). Feedback pathways: (1) competence-confidence; (2) motivation-active participation; (3) fun-enjoyment-pleasure; (4) connectedness-relatedness; (5) creativity-agency; (6) general cycle related or positive movement experiences.

> "I truly believe in the idea of physical literacy, getting the kids the skills and confidence to try things on their own. I think if we can get kids to be confident, competent movers, then we've sort of hit our goal."- Lenny (*1,2*)- T1Q1

In fact, participants described their role as a PE teacher to include exposure to and experiences in a wide variety of different activities, departing from the traditional sport exposure model. The teachers focused on PE as a vehicle for students finding their movement interests, ones that the student could use for the rest of their life, which is nicely described by Eddie as: "opportunities to get engaged in a variety of different activities to improve their physical literacy" (*2*)-T1Q2. This role as a PE teacher is further supported by Marley who describes PE as an embodied movement experience:

> "My biggest role is to teach children or facilitate experiences where they get to know their body and how it moves in the world and the importance of just using their body so that they will have health and wellness as they move forward the rest of their lives."- Marley (*1,2,4*)- T1Q3

In their own way, all participants described teaching strategies that supported activation of all components of the physical literacy core cycle (competence→ confidence→ motivation→ active participation) (33). Within the competency domain of physical literacy, Eddie discusses the importance of finding a level of challenge for all levels of ability so as to engage all in a competency progression, and incrementally progress each student:

> "I think just knowing how to progress the students, where to start with the students for the proper grade level and age level, I think that's one. And then being able to recognize when it's time to move on to new progressions and what progressions to use, what aims to help them, to teach them, or to introduce to them, to keep them engaged, keep them learning and allow them to practice and apply their skills in."- Eddie (*2,5*)- T1Q4

In addition to competency progressions, teachers also referred to the importance of enjoyment and confidence development in their students. Lenny mentions their views on the critical and intentional linkage between enjoyment and confidence for holistic development of the student:

> "I think the biggest thing for me is trying to get them to enjoy the things that they're doing so that they have that confidence. Because at the end of the day, with the age I'm working with, they're still kids. So, if they're not having fun, then they're not going to do these sorts of activities when they're older. And that comes with confidence. So just giving them the tools to learn things that they're able to do and also have a variation of activity"- Lenny (*1,2,3*)- T1Q5

Though discussed less explicitly, participants often referred to student motivation in alignment with engaging all the students in active participation. Marley discusses how frustration as a result of striving for perfection sometimes results in demotivation to participate, but also highlights strategies used to mitigate this:

> "I have very few instances where students are sitting out or feeling overly frustrated. It still happens, but mostly because they're at the point they're in the mind frame where they have to do this skill the perfect way. But for people that are invited to just express themselves in different ways to like I have very few people feeling less confident with their skills, I think."- Marley (*1,2,5*)- T1Q6

In order to obtain engagement of all students of different abilities, Gord discusses strategies to avoid social inhibition (the so-called audience effect) among their students through small group activities:

> "But overall, it's definitely a way to increase participation. Those kids that maybe would shy away are now a little bit more keen to come do something in the day like. So if we're working on just some coordination and agility type skills with ladders and obstacles and stuff like that, if they're an uncoordinated kid, they're going to maybe shy away from that. But if it's just a small group and a couple of kids, they'll definitely I feel like they're more keen to come and try it out there."- Gord (*1,2,4*)- T1Q7

3.2. Theme two—movement within and beyond PE

Participants listed a remarkable number of movement opportunities that students are exposed to within this school division, that span well beyond the traditional sport-centric focus in PE. Some unique activity examples that the teachers provided included: "wheeled motion", fat tire biking in snow, bouldering/rock climbing, the key families of circus arts (acrobatics, manipulation, equilibrium, and aerials), parkour, cross country skiing, disc golf, Indigenous dance, swim programs, and fishing/ice fishing to name a few. Teachers understand the value of movement in diverse physical and sociocultural contexts, and all emphasized the importance of movement experiences beyond the school grounds and within their community. As the teachers listed the different activities their students were exposed to, they expressed the importance of these exposures for future participation:

> "I believe my role is to be part of positive experiences and connections with movement, help kids build confidence so that they can further their competence. That is language that's been in my mind lately going to pursue lifelong physical activity so that they're comfortable moving in different domains."- John (*1,2,4*)- T2Q1

Despite the pressure often placed on PE as a way for students to achieve minutes of physical activity, no teachers in this study mentioned achievement of moderate or vigorous activity as the goal of their PE class or that becoming a "sweaty mess" was the primary experience they were hoping for students to get out of PE. This shift away from a physical activity way of thinking to a physical literacy way is supported by Gord:

> "That's my hope is that they're going to go out and do it on the weekend because that's the problem, they come to school 9 to 4, and then they go home and plop down on the couch and I'm like, okay, that defeats the purpose, right? Like, okay, it's good you're active then, but now you're kind of giving up, right?"- Gord (*2*)- T2Q2

In addition to supporting lifelong active participation through the content delivered in PE, once again confidence and competence in a range of different activities is mentioned by Eddie as a way to foster both a lifelong interest in movement and an ability to self-organize (agency): "We had a girl who learned to ride the unicycle. Her mom went out and bought her unicycle. Now she's riding unicycle down the sidewalk at her house."- Eddie (*1,5*)- T2Q3

As the interviewed teachers are often trying new activities with their students, a sense of trust and communication was identified as important between the teacher and their students, and perhaps the teachers were establishing a more effective working alliance through tripartite efficacy (34). As such, rapport with students was also mentioned by Eddie as a critical part to success in the gymnasium:

> "I think we have a good relationship and a good rapport with each other. So I think we are able to respect one another and we have that classroom management that is a lot better. Just because they want to be in the gym. You spend a lot of time in the gym working together on skills. You're helping them to build skills and build confidence. And I think all that allows you to build a good relationship with a student and a good rapport."- Eddie (*1,4*)- T2Q4

3.3. Theme three—inclusive and individualized experiences

Physical literacy as a construct that is inclusive by design, as suggested in the core principles of Canada's physical literacy consensus statement (35), was supported by many of the participants in terms of their practices and experiences. Gord shares how their classes are structured "so those that do have any kind of intellectual disability or physical disabilities are coming in and I feel like they're there in the program, just like everybody else, there is not really any differentiation happening" (*2,4*)- T3Q1. This approach is further supported by John, where they discuss how they strive to have everyone authentically participating:

> "Yeah, I think any time you can widen that reach so that everyone is participating in the same activity, I think that you're achieving inclusion because you're not pushing anyone to the side necessarily. You're saying, okay, we're working on balance, we're working on coordination, we're working on strength, we're working all these areas of success. Someone's working on balance. They're included just as much as the one up in the air working on strength. They're all part of the same production."- John (*1,2,6*)- T3Q2

Participants also discussed the importance of individualized approaches in class to further foster the development of a child's physical literacy regardless of a student's level of ability. Specifically, Gord mentions a student peer to peer teaching strategy:

> "So I feel that, that idea of the station work and the individual work and that peer teaching, I think it makes it a very welcoming environment to anybody, whether you're skilled or not skilled or you have any kind of disability that's affecting how you might participate in phys ed. I don't think I don't see a lot of exclusion in any way in our program, it's very inclusive to everybody."- Gord (*4,6*)- T3Q3

The peer teaching also saw spillover into the recess space, as further described by Gord: "In terms of recess activities, the peer teaching, you see it outside. They'll be doing games outside, they're playing and there will be kids teaching other kids how to do certain skills" (*4,5,6*)- T3Q4. Some of the traditional sporting games (TSGs) commonly played at recess included tag games, ball games, and team games. The wide range of physical, psychological, and social abilities within a single PE class can make inclusive practices challenging at times, but John discusses how they make it work, and the benefits when it is accomplished:

> "I think the first thing that jumps to mind directly relating to circus is the ability to differentiate instruction. It's by far the hardest thing to do. When you see the wide range of abilities that we work with in a class of 25 kids, that being able to reach all sides, that umbrella or that spectrum of learner… I think circus just kind of naturally creates that umbrella in that safe space for students to step into that world. On whatever scale they feel comfortable with, whether they're just wanting to stay grounded, try something low risk, but at the same time challenging. They can build from there."- John (*1,2,5*)- T3Q5

Further supporting the idea of an umbrella of safe space, by providing students with individualized challenges, teachers also recognized the positive impact on student resilience. Eddie shares how they teach students to deal with failure, and the fact that failure is not the opposite of success, but a part of it:

> "That's that resilient piece, right? Like learning to fail. You're going to get scored on. What do you do? Or you're going to drop a ball in juggling or, maybe you can't do a cartwheel at

> this time, but let's work on these progressions and eventually you'll get there." – Eddie (*1,2*)- T3Q6

These individualized approaches also include opportunities for creativity through movement, as described by Marley: "It's more of a global movement of like, how do you like to move and just and ways that we can get there faster, or ways that we could get there slower, and ways we could get there higher, and we get there lower" (*2,6*)- T3Q7.

Teachers also described how their risk perspective shifted from a somewhat surplus safety to an adequate safety mindset (36) based on their experiences and professional development. As exemplified by Gord: "I think post circus training, my tolerance for risk went up like 100-fold" (*1*)- T3Q8. This teacher's mindset fostered a healthy risk perspective in their students "if you feel safe doing it and you can do it, then do it" (*1*)- T3Q9 for physical contexts of risk but this mindset also fosters a healthy psychological risk perspective through student peer mentoring and performance. This shift in risk perspective by teachers then transferred to how they allowed their students to manage risk, find their optimal challenge, and thus create their individualized experience. Gord elaborates on this by stating:

> "I like the idea of if you feel comfortable doing it and you feel safe, then do it. And I feel like giving that ability to the individual, it's unreal. On some of the aerial stuff we do, like if you tell the kid, if you feel safe, you want to try it and you know how to fall safely and then they're the best judge of their own ability versus me saying, 'everyone's doing back rollovers'. Some kids will never do that because they're too afraid or some kids will do like, can I do it off a box? They're making up these crazy skills so they're the best indicator of their own success, their own challenge level."- Gord (*1,2,5*)- T3Q10

3.4. Theme four—physical literacy practices bringing the school community together

The participating teachers have described the various ways in which physical literacy enriched practices are present, but they have also noted how the physical literacy language has helped as well. Marley mentions "yes, it's helpful to have that language to kind of express my beliefs that I kind of have that have developed over time" (*6*)- T4Q1. In addition to language that supports their practices, participants emphasized how their physical literacy enriched PE garnered attention from parents:

> "I hear a common response from a lot of parents and teachers is this isn't what it looked like for me. I wish it looked this way. I wish this was the kind of phys ed classes that I had or the experience I had because I probably would be or would have been more likely to pursue movement."- John (*6*)- T4Q2

Gord further emphasizes the connection with parents, while also mentioning the unique collaborations that circus in PE allowed for among PE, music, and drama teachers. This remark was shared by the other participants who also run a circus arts instruction program.

> "When parents have been in the building over the last, let's say five to six years, then yeah, for sure, you get a lot of the comments like 'oh where was this when I was in phys ed'? You always hear that comment. And then, when circus first came in it was a big, big hoopla for the parents. They were like, this is amazing. So, we had a circus performance one night and the next year we tied in with our music teacher, did a circus themed musical. So that was a really big deal when it first came in and still is big, but it's not quite the same when it first started up for sure."- Gord (*1,4,6*)- T4Q3

A supportive school-community environment is also key when teachers are trying new things in PE, as identified by Lenny:

> "I work at a school where everybody's really supportive, so that made it really easy for me to like to know that if I tried something and it didn't work, I wasn't going to get in trouble, there wasn't any real huge consequences to that. So, giving that like carte blanche to really give those things a try was really important."- Lenny (*1,4*)- T4Q4

Additionally, school support staff play an integral role in the physical education experience of students, and John highlights how their thinking has evolved around working with support staff, and the effort it sometimes took to get there, given previous negative experiences of the support staff:

> "The percentage is shocking, how many people did not have a very good experience with their phys ed class or with their teacher. I think that it opens their eyes not just for them personally, but for how they perceive children who are struggling in the class academically and then they see them succeeding in the gym. I think it builds a feeling of hope within physical education… I think that when we get language that's shared amongst staff and that's happening a lot in my building, with support staff and teachers being educated on what we're working on to create an inclusive space. There's a shared common goal that's really valuable that gives a feeling of optimism to the kids."- John (*2,4,6*)- T4Q5

Another key piece is the community of practice that has developed among teachers within the division. Eddie describes the importance of the communication that takes place between teachers as a way to further develop their thinking and pedagogy around physical literacy:

> "We're a pretty good group. And amongst all the early years teachers in our division, we have kind of our own, like not our own little groups, but we have kind of the circus group

> that we all talk to. And I'd say I give credit to the PE/HE coordinator again about giving us release time and opportunity to get together to create documents on what's the best circus progressions for the new upcoming teachers or teachers who are taking the circus course and starting out. I give credit to the PE/HE coordinator for allowing us to have time to get together and talk about it and make documents on the kind of the trial and errors that we've had. And what we figured out was the best progressions to deliver the circus program or the teaching games for understanding program. Yeah. I think, there's definitely a strong community."- Eddie (*1,2,5*)- T4Q6

The community of practice that Eddie mentions, in addition to the collaborations with other teachers and administrators within an individual school, and connections with parents presents an encouraging community developing around physical literacy enriched practices.

3.5. Connecting the findings to QPE

UNESCO (11) identified six elements as foundational for QPE leading to the development of physically literate students: frequency, variety, inclusivity, value context, peer-led learning and rounded skill development. All six of these QPE components were supported by findings in this study. *Variety* was exemplified by teachers not only by the number of different activities that students were exposed to, but also regarding variety of teaching approaches and class styles (e.g., circuits, self-directed/peer-led, teacher-led, etc.) (see T1Q2, T2Q4, T3Q3). *Inclusivity* was demonstrated based on the provision of a level of challenge for all levels of ability (see T1Q4) and variety of activity disciplines offered which reduced potential biases related to ability or gender (see T3Q1, T3Q2, T4Q5). Although inclusivity was not a topic that was specifically probed in the interviews, many teachers spoke to having children find their passion for movement or "movement voice". The teachers adopted numerous approaches to achieve positive valuation (*value content*) of the PE class by the students. These included the provision of a variety of content and options that would be perceived as relevant and activating for the child. Further, teachers identified that a goal was to have all children achieve a net positive emotional valance to participation in PE class (37) leading to a sense of belonging (see T2Q3, T4Q1). *Peer-led learning* was a strategy often discussed as a means to further engage and support positive experiences for all students (see T3Q3, T3Q4). *Rounded skill development* was evident based on teachers identifying the importance of providing a variety of movement experiences beyond the traditional sport-centric approaches (see T1Q2, T2Q1), and the emphasis all teachers placed on preparing students for continued movement beyond the school context (see T1Q3, T2Q2, T3Q7). Although there are no specific quotes for *frequency*, the delivery of PE met or exceeded the minimum standard for elementary schools in Manitoba (target of 150 min) with a frequency of 4–5 classes per week and class durations of 38 min. Interestingly, this school division also had a high frequency of professional development days offered per year (about 4 per year), as well as a strong community of practice, which was discussed (see T4Q6).

3.6. Enhanced physical literacy cycle

Based upon the participants' discourse and explanatory to the themes, the physical literacy cycle (See **Figure 1**) proposed by Stuckey et al. (31) was modified to; include four sub-domains (physical, psychological, creative and social) in the confidence-competence pathway to represent the holistic development of the student; include different forms of connection (self, people, places, objects, groups and living things); explicitly include a decision making/problem solving feedback pathway leading to agency and creativity (replacing autonomy); include the notions of fun and pleasure leading to enjoyment of movement; and the notion of developing a healthy risk perspective being developed across physical and psychosocial contexts.

4. Discussion

This study identified the practices and perspectives from six elementary PE teachers through a physical literacy enriched pedagogy lens in a high-quality PE context. Four themes emerged that provided a better understanding of physical literacy enriched pedagogy. The themes from the interviews predominantly identified processes based on their practices, and we saw a natural fit to the most recent iteration of the physical literacy cycle (31). All participants spoke about how their pedagogy focused on the holistic development of their students, which emphasized activation of different feedback pathways of the physical literacy cycle (31). The themes that emerged and subsequent insight gained from teachers went beyond existing physical literacy cycles (31, 33), in particular by discussing holistic development of students from a physical, psychological (cognitive and affective), social and creative (problem solving) perspective, supporting an expansion to the existing model as presented in this paper (**Figure 1**). The holistic nature of participants' practices supports the idea that these PE programs were representative of QPE, which includes: "Quality physical education is distinct from physical education. The main differences relate to frequency, variety, inclusivity and value content. Quality physical education is about peer-led learning and rounded skill development which can enhance educational and employability outcomes." (11). The unique characteristics mentioned by UNESCO, which similarly align with features of meaningful pedagogy (18), were evident in the participants' description of their teaching practices, supporting a QPE experience and physical literacy development. The physical literacy enriched pedagogy of these teachers were well suited, and in fact directed to development of a physically literate student which included consideration for the emotional wellbeing of participants with all levels of ability. Further, the pedagogy fostered the creation of creative agency through the provision of

problem solving and decision-making practices (as opposed to purely prescriptive approach).

Physical literacy enriched pedagogy can support new ways to engage students in a positive movement experience in PE through achievement of a net positive emotional valence (37), and perhaps prevent the accumulation of negative movement experiences (32). Physical literacy enriched pedagogy practices outlined by teachers align with existing literature and included: a level of challenge for all levels of ability (22); genuine connection (to self, people, places, objects, groups, and other living things) (22) leading to the development of a movement voice and a sense of belonging; teamwork and empathy (38, 39); opportunities for creative movement (40); the development of a healthy risk perspective (36); concurrent confidence and competence progressions (31); and a high level of engagement by all (active participation) (8). More specifically, teachers mentioned how their pedagogy focused on competency development, in the form of physical competence, but also social, creative and psychological competencies such as peer to peer teaching, prescriptive and creative progressions, and mitigating student fear of failure (i.e., intentional confidence development). Integrating progressions, which was mentioned by all participants, further supports intentional confidence development as it offers a level of challenge for all levels of ability (physical, social, creative, psychological) (22). Teachers identified the importance of setting the optimal challenge for each student, where the positive affect accomplished during and upon completion of tasks would supersede the initial negative emotions, such as anxiety or self-doubt. Students engaged in "overcoming challenges" may be a resilience building process leading to enhanced ability to overcome adversity in and beyond the school walls (33). The valuation of movement in different contexts as exemplified by these teachers, may provide an affordances mindset for students to act as their own agents within and beyond the PE context (20, 41). The participants identified the importance of authentic relationships with students, this could foster a working alliance through the development of tripartite agency (34) leading to positive valuation of the PE classes (37). Children have identified that being engaged in a competency progression (i.e., learning something new) is fun (42) and upon reflection these children would associate enjoyment with the class leading to increased likelihood of lifelong participation in movement (14, 43). Through the intentional construction of positive challenges using physical literacy in PE, participants also suggested this supported student engagement, motivation, and continued participation within their PE classes. Ultimately, given repeated provision of positive movement experiences in the PE context, this could lead to the association of happiness with physical activity as students emerge into adulthood (9, 32). The combination of these pedagogical practices over the course of a PE program supports the activation of the physical literacy cycle and the various feedback pathways, in a variety of different movement and social contexts.

Despite the emphasis of PE as a way for students to achieve minutes of MVPA (44, 45), no teachers in this study mentioned MVPA as the goal of their PE class or as the primary outcome they were hoping for students to get out of PE. Although it is agreed that a more active society is important, if physical literacy is not the foundation for pedagogy, it is likely practice will revert to a physical activity focused "sweaty mess" thinking. While physical activity and fitness motifs were not the goal, as a result of the practices and high levels of student engagement, these outcomes were likely still achieved secondarily. This finding is in alignment with Ramer and colleagues who found that enjoyment of physical activity was a better predictor of future participation than the amount of MVPA (43). Teachers' strategies were focused on more holistic student development and future activity participation, not typical sport-centric approaches (15) including intentional play and performing arts-based exploration of skill development. This demonstrates a shift in thinking among participating teachers towards intrinsic valuation of movement as opposed to instrumental valuation of movement focused on "meeting the guidelines" and fitness motifs (5, 6). Many of the teachers discussed how their goal is to expose students to a wide range of different activities (in different environments), to support continued participation in activities of their choosing within and beyond the school context, emphasizing student inclusion and an ability to self-organize movement (agency) fostered through decision making opportunities. As reported by Bremer et al., children highly value movement, and when children have the opportunity for creativity and agency, the physical literacy cycle is further supported (22, 40, 41). An example of the inclusive and agency supportive environments in these PE classes is "wheeled motion", where students can choose to navigate the constructed gymnasium space using the wheeled device of their choosing (e.g., scooter, razor bike, rollerblades, ripstik, etc.). Another example mentioned by the participants was the shift away from traditional climbing approaches to the creation of bouldering walls with the intent of teaching students how to navigate the world and problem solve, rather than achieve specific climbing levels. In this way, students once again were provided with choice requiring decision making, and the different levels of challenge provided were conducive to all participants finding a competency challenge suitable to their level of ability (21, 46, 47).

The physical literacy enriched delivery of TSGs has been identified as a critical component of quality pedagogy by participating teachers to support holistic development of their students through quality PE practices (11). For example, physical literacy enriched "teaching games for understanding" games, which include target games, striking games, net/wall games and invasion/territorial games (48), were identified as key elements for PE curricular delivery. Physical literacy enriched pedagogy in combination with nonlinear pedagogy, can be used to guide the development and adaptation of all forms of games, including TSGs, for the achievement of inclusive and positive movement experiences (22, 49). Further, the approaches outlined in this paper within the PE context have immediate application to support TSGs and other games in recreation, performance arts, early childcare, and afterschool sport programs, which has been described in other studies (50).

This may be a model jurisdiction QPE in practice. There is clear value placed on physical literacy and quality PE within this division based on their multiple professional development days a year focused on physical literacy and quality PE, a designated PE/HE coordinator (who fosters and facilitates 3–5 professional development days per year, as well as performed organizational and acquisitional duties that would normally be on the "side of the desk" of teacher), and strong support from administration (superintendent, trustees, and city councillors), other staff, and parents. The combination of these investments and efforts has resulted in the intentional design of PE opportunities that support physical literacy development of all students (holistic and inclusive). Effective delivery of curricular outcomes is dependent on the type of pedagogy illustrated here, and systems to foster this pedagogy are required (education degree, professional development, etc.) to further the quality physical education initiative (10, 11). Further, the physical literacy enriched pedagogy that has emerged in this PE context would have clear application in fostering quality coaching, recreation and even performing arts pedagogy. We believe that a combination of the above factors in other jurisdictions would be a promising way to support physical literacy enriched pedagogy leading to a jurisdiction which exemplifies QPE.

4.1. Limitations

The current study is limited to the province of Manitoba, and although many experiences may be similar in other provinces and countries, the potential for variation in supports and priorities exist. For this reason, there is an opportunity to conduct future research in implementation science in different communities, to explore the similarities and differences in experiences, looking at process and outcomes. Given the potential differences based on location, future research could expand on the importance of clear roles and priorities within a physical literacy enriched pedagogical approach in different regions. This study was also delimited to the elementary context, and caution is advised to extrapolating these findings to middle and high school contexts, until further research is conducted.

5. Conclusion

The four major themes presented here provide support for the notion of physical literacy enriched pedagogy based upon activation of the physical literacy cycle and addressing all the key components of QPE as proposed by UNESCO (10, 11). The inclusive pedagogical practices articulated here support the holistic development of students including their socioemotional wellbeing and their agency and creativity (intelligent decision making). This school division has taken many steps to develop a supportive physical literacy and PE co-culture, providing a quality example of physical literacy enriched pedagogy in practice. These steps have led to teachers seeing merit in using physical literacy as a vehicle for QPE. There was a clear articulation by the participants of activating various feedback pathways of the physical literacy cycle directed to the development of movement skills but also the development of agency through problem solving and decision making; intentional and concurrent development of competence with confidence, a key psychological characteristic for wellbeing; provision of a level of challenge for all levels of ability for inclusion; and fostering various forms of connection for the student's belonging through movement. Insights provided by the teachers allowed evolution of the physical literacy cycle. This physical literacy cycle could be used as a framework for lesson planning in PE, as well as other movement contexts (sport, recreation, performing arts) for holistic development of students to achieve holistic development of children through the construction of positive challenges leading to positive movement experiences for all.

Data availability statement

The datasets presented in this article are not readily available because the data that support the findings of this study are not available due to ethical restrictions. Requests to access the datasets should be directed to natalie.houser@umanitoba.ca.

Ethics statement

The studies involving human participants were reviewed and approved by University of Manitoba's Health Research Ethics Board (H2021:401). The patients/participants provided their written informed consent to participate in this study.

Author contributions

NH and DK were responsible for the conception of the project, methodology, and data collection. NH and DK were responsible for data analysis. NH and DK were responsible for the interpretation of the results, writing, and editing of the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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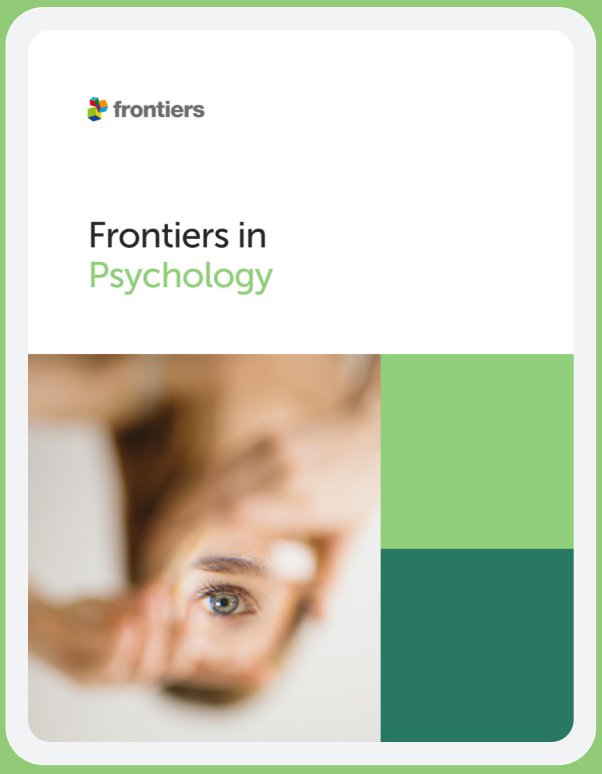

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