Implementation of Game-Centered Approaches in Physical Education: A Systematic Review

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Abstract:

This study conducted a review of the research focused on six game-centered approaches (Teaching Games for Understanding, Tactical Games Model, Step-Game Approach, Invasion Games Competence Model, Game Sense and Play Practice) in Physical Education between 2015 and 2021. A systematic review method was used, which included searching in electronic databases, selecting studies based on pre-established inclusion criteria and refining this selection to identify research-based papers. A total of 46 articles were selected, and information was retrieved about the study context and purpose, the participants, the methodology used and the main findings. The manuscripts were analyzed using thematic analysis. Results suggest that game-centered approaches research increased over the last years, with the Teaching Games of Understanding outstanding as the most popular. Studies commonly investigated experienced teachers (with more than five years of experience), the middle school grade, team sports and proposed to compare two distinct teaching approaches (tactical approach vs traditional teaching), concluding that game-centered approaches are more effective in diverse domains (e.g., decision-making, physical activity levels, perceived effort, motivation). Overall, most studies implemented single teaching units, using multiple data sources collected over short periods of time, mostly based on quantitative procedures. Future research should prioritize: 1) more empirical studies on Step-Game Approach, Invasion Games Competence Model, Play Practice and Game Sense; 2) hybrid pedagogical approaches; 3) expanding research on individual sports; 4) using pre-service, novice teachers and primary students as study participants; 5) deepen the investigation of the processes that contribute to teaching and learning tactics; and 6) the use of longitudinal intervention-based study designs.

Key Words: Instructional models, student-centered approach, teaching sports, school context

Introduction

Extensive research has long been upholding the high educational value of student lifespan participation in Physical Education (PE) (e.g., Beni et al., 2019). For connecting strongly with students' personal and cultural representations of sport and fueling children's high enjoyment through participation in collaborative achievement of motor and social goals, the teaching and learning of sports have long been a central interest of practitioners, researchers, and teacher educators in PE (Hastie and Mesquita, 2016). Thus, in line with the societal demands of developing autonomous, critical thinkers, and responsible human beings who can adapt to rapidly shifting life circumstances, the teaching of sports in schools has moved from explicit and formal character of instructional process, evident in the traditional teaching (called teacher-centered approaches) (Gubacs-Collins, 2015), to student-centered approaches of the PE curriculum.

As a consequence, the implementation of game-centered approaches (GCAs) for teaching and learning sports is currently mandatory in several PE programs across the world (Barba-Martín et al., 2020). In this vein, several prominent GCAs have been developed and implemented in PE context such as Teaching Games for Understanding (TGfU; Bunker and Thorpe, 1982) and their follow iterations, namely the Tactical Games Model (TGM; Mitchell et al., 2006), the Step Game Approach (SGA; Mesquita et al., 2005), the Invasion Games Competence Model (IGCM; Musch et al., 2002), the Game Sense (GS; Light, 2004) and the Play Practice (PP; Launder, 2001).

Besides the implementation of any GCA to involve a common matrix of pedagogies, each one of these models has unique internal structures and functionalities. The exemplary advent of the Teaching Games for Understanding (TGfU) (Bunker and Thorpe, 1982) has been a ground-breaking proposal to the teaching and learning of sports in PE, representing an important revolution in the way of sports were worked out from an educational perspective (Harvey et al., 2018). The approach places a strong emphasis on the very basics of playing games as grounded on student enhanced tactical awareness (i.e., the ability to identify tactical problems that arise during a game and its appropriate response) (Mitchell et al., 2006). Based on extensive practice of small-sided games, and on the predominant use of questioning strategies, TGfU engages students in discovery-learning of adequate tactical, technical, and strategic solutions to game problems (Hastie and Mesquita, 2016).

One of the most prominent iteration include the Tactical Games Model (TGM). Griffin, Mitchell and Oslin (1997) presented a simplified 3-step model to teaching sports concepts and skills, where students are invited to develop the on-the-ball skills/off-the-ball movements associated with a coherent game structure and increasing tactical complexity. Thus, this model intended to develop students' ability to understand and act in the game in reference to comprehensive tactical principles (problems) that are common to different categories of games (e.g., scoring/prevent scoring: invasion games, net/wall games, batting-striking games), and/or games within the same category (i.e., creating/using/defending space: invasion games, ultimate-frisbee, football or hockey-based games) (Mitchell et al., 2006).

In addition, the SGA and the IGCM have been rising as GCAs. Both models pose progressive (step-by-step) game problems to students challenge their ability for understanding and performing at their current expertise level (Hastie and Mesquita, 2016). Although these models preserve the TGM focus on games learning in reference to a specific framework of core tactical principles and problems and they predominantly made use of teacher tactical questioning and student extensive practice of small-sided games which are representative of the formal version of the main sport (Mitchell et al., 2006), they proposed several pedagogical advances. The SGA and the IGCM: 1) take into account the specific nature of a single category of games, the network/wall games (SGA) and the invasion games (IGCM); 2) the content (on-the-ball skills, off-the-ball movements) and the respective learning goals are developed in according to a more specific framework of situated and context-unique tactical problems (e.g., players loose ball possession for not pivoting, players don't defend a point for not anticipating the ball trajectory and bodily adjusting, etc.); 3) embrace the foundational content development principles of Rink (2013) 'Skill Development Approach', and thus, the tasks progression extend beyond 'generic' practice tasks, toward applying, refining and extending tasks in different levels of task representativeness (SGA: adaptation, structuring, acquisition tasks; IGCM: basic game forms, partial game forms, game-like tasks).

Approaches to sport teaching with similar intentions to TGfU also include GS and PP. The GS has a specific educational intent on developing a player as *"thinking, feeling and physical being that interprets and makes sense of learning experiences shaped by the knowledge and inclinations that he/she brings to the learning experience"* (Light, 2010). The two core features of GS are (Light, 2004): 1) the use of questioning, asking questions instead of telling students what they should do moved the focus of teaching from the teacher to the students (i.e., from teacher to student-centered approaches); and 2) most learning is shaped and contextualized within games or game-like activities that involve competition and decision-making. The PP is seen a result of Launder (2001) experiences as a teacher, coach and physical educator. As the above-mentioned iterations, the PP advocates learners playing modified games as the central organizational feature of a lesson. There are used principles of shaping play, focusing play, and enhancing play to create play practice progressions for novices or experienced participants (Launder, 2001), allowing that *"what is tactically desirable must be technically possible"* (Launder and Piltz 2013, p. 59). To achieve this, their processes are easy to understand and to implement in practice, which is important because teachers are more likely to commit to transforming their practice if they clearly see how they connect to their own experience (Piltz, 2015).

In their well-accepted scoping review, Harvey and Jarrett (2014) identified a rapid growth of research on GCAs in all continents and a cumulative of evidence of the positive impact of GCAs on students' decision-making, technical skills and physical activity levels, with rising focus of research in the affective domain. However, the authors outlined a number of key challenges to be tackled in future GCA research, which included the lack of longitudinal research designs and dearth of knowledge of adequate GCA induction and training for teachers. In addition, the authors claimed the need of the implementation of hybrid pedagogical approaches, *"suggesting that multiple instructional approaches can be utilized to enhance teaching and learning process"* (Harvey and Jarret, p. 291). In fact, recent systematic reviews on instructional models have shown that no single model is capable of fitting all the teaching-learning contents and contexts, which led scholars to combine different instructional models into hybrid model-implementation (González-Villora et al., 2019a; Silva et al., 2021). The number and diversity of hybridized model implementation has substantially increased in recent years, which calls for a more exhaustive review analysis. Posteriorly, in 2015, Miller conducted a systematic review focus on GCA studies, quantitatively analyzed, concluding that exists an association between the use of GCAs and students' outcomes, for example, declarative knowledge, support during game play and affective outcomes of perceived competence. Nevertheless, the author reinforces the value of longitudinal and intervention research and recommend the exam of the use of GCAs and potential psychological, physiological and behavioral outcomes in students.

We are aware of other systematic reviews where GCAs have been included, however they were carried out with different purposes and in other contexts. For example, Barba-Martín et al. (2020) presented students' learning outcomes (motor, cognitive, social, and affective) but only focused on TGfU; González-Villora et al. (2019a) aimed to assess hybridizations conducted among instructional models; Silva et al. (2021) wanted specifically to understand the challenges faced by pre-service and novice teachers in the implementation of student-centered models, as GCAs, Sport Education (SE), Cooperative Learning (CL), etc; and the review conducted by Kinnerk et al. (2018) was in the context of competitive team sport settings. Importantly, none of

the existing systematic reviews exclusively focus on multiple GCAs (e.g., Oslin and Mitchel, 2006; Harvey and Jarret, 2014; Miller, 2015), has included the SGA, with the interest in IGCM being residual.

It is important to take stock of the state of research in relation to GCAs, which are conceptually based on SCAs and focus on teaching contents (i.e., sports). Therefore, this systematic review of the GCA literature had two aims: (a) to provide an updated analysis on the literature surrounding GCAs to teaching sports in PE context since 2015, expanding the scope of previous reviews to incorporate additional GCAs; and (b) to examine the findings involving the implementation of six GCAs (TGfU, TGA, SGA, IGCM, GS and PP), and their hybridizations, by PE teachers within the school context. Specifically, five research questions guided this systematic review: (Q1) Which contexts have been mostly researched? (Q2) What have been the main purposes of the conducted research? (Q3) Who have been the researched participants? (Q4) Which have been the prime methodological procedures employed? and (Q5) What are the main research findings?

Material & methods

Search limits

Since the last systematic review focused on teaching multiple GCAs in the context of PE was conducted in 2015 (Miller, 2015), our electronic search included articles published from 2015 to January of 2021. The electronic search was conducted in September 2020 and updated in January 2021 in three databases (EBSCO, that include Academic Search Ultimate, ERIC, Education Source and Teacher Reference Center; Web of Science and SCOPUS) and involved a general identification of the manuscripts published within PE school context. The search strategy was applied to the articles' title/abstract/keywords' and combined the following terms: 'Teaching Games for Understanding' OR 'Tactical Games Model/Approach' OR 'Step-Game Approach' OR 'Invasion Games Competence Model' OR 'Game Sense' OR 'Play Practice' OR 'Game-centered Approach' AND 'Physical Education'. The search was performed by two experts within the research field of GCAs.

Study selection

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement was followed in conducting and reporting this systematic review (Moher et al., 2015). The stages of the search and the study selection process are presented in Figure 1. Given the possibility of the reported studies have not been involved in an expert peer-reviewed process, book chapters, review or opinion articles, dissertations, conference abstracts, articles published in non-peer reviewed journals were automatically excluded. Thus, for being included the articles had to: 1) be focused on PE, SCA and GCAs, 2) have a program implemented by a PE teacher, 3) be published in peer-reviewed international journals indexed in the Journal Citation Report (JCR) or the Scimago Journal Rank (SJR), with full text-available, 4) written in English, Spanish, or Portuguese, and 5) published between 2015 and January of 2021. Additionally, no restrictions were placed on participants' age, skill, or sex.

Fig. 1. Study flowchart of study selection process based on PRISMA (Moher et al., 2015).

Methodological Quality Assessment

The methodological quality evaluation of the manuscripts was performed through the validated Mixed Methods Appraisal Tool (MMAT) (Hong et al., 2018), which was specifically conceived and designed for the appraisal stage of complex systematic literature reviews, and thereby enable us to evaluate qualitative, quantitative, and mixed-methods studies. Specifically, this scale encompasses seven questions that could be answered as “yes”, “no” or “can’t tell”. Thus, the quality ration was defined as follows: if the study had between 0-3 questions answered with ‘yes’, the study was classified as Low quality; if it had 4–5 ‘yes’ it was classified as Medium quality; and if it had 5–6 ‘yes’, it was considered as High quality. The first author and one co-author performed the methodological quality assessment of the studies selected, with both debating the punctual differences until achieved a consensus. It is worthwhile to mention that no study was excluded due to a significantly low-quality assessment score (Table 1).

Data analysis

Several information was retrieved from the articles selected regarding study context (author(s), year of publication, country where the research was performed, model implemented, type of sport assessed (individual or team sport), study purpose, participants (teacher experience and student’ school grade level), methodology (tactical unit length, study design, data sources and quality rating) and main findings (Table 1 and 2 for further details). To answer the (Q2) (what have been the main purposes of the conducted research?) and (Q5) (what are the main research findings?), thematic analysis was used once it allows “to identify those relevant (patterns) to answering a particular research question” (Braun and Clarke, 2012, p.57). First, each study was red and summarized by the first author to identify and codify relevant findings that addressed these research questions. Next, codes were compared and categorized based on their meaning and associations, affording the construction of thematic clusters and categories. To ensure the high-quality of analysis, these categories were discussed between the authors, and afterwards labelled and grouped into major categories. Exploring links between categories enabled the development of a conceptual understanding about the entire data set. The established categories were finally revised and refined by all authors according to the research questions.

Table 1. Overview of the included studies (n=46)

Author and Year	Study context	Study purpose	Participants	Methodology
1.Araújo et al. (2015)	Portugal, SGA/SE, TS	Examine a hybrid unit on students’ gameplay performance, considering sex and skill-level	1 E; Middle	25; QTNr; single data source; HQ
2.Farias et al. (2015)	Portugal, IGCM/SE TS	Examine a hybrid unit on students’ game performance and understanding in soccer	1 E; Middle	17 QTNr multiple data source; HQ
3.Kockoek and Knoppers (2015)	Netherlands TGfU, TS	Explore students’ perceptions of collaboration, group formations, and friendships	1 No info; Secondary	6; QL; multiple data source; HQ
4.Slater and Butler (2015)	Canada, TGfU, No info	Compare a discourse analysis of a PE class and a science teaching using the TGfU	1 No info; Middle	12; QL; multiple data source; HQ
5.Chatzipanteli et al. (2016)	Greece, TGfU, TS	Examine the effectiveness of the TGfU in promoting metacognitive behaviors	2 No info; Middle	8; QL; single data source; HQ
6.Harvey et al. (2016)	USA, TGM, TS	Investigate the effects of TGM delivery on MVPA/VPA and gender/school level differences	2 E; Primary and Middle	24+ 30; QTD; single data source; HQ
7.Nathan (2016)	Malaysia, TGfU, IS	Compare the effects of TGfU and Skill Drill Technical on learning movement skills and explore teachers’ perceptions between the two models	2 E; No info	12; M; multiple data source; MQ
8.O’Leary (2016)	England, TGfU, IS	Investigate how an experienced teacher delivered TGfU and the factors that influenced his learning	1 E; Middle	4 months; QL; multiple data source; MQ
9.Pizarro et al. (2016)	Spain, TGfU, TS	Analyze the effects of the TGfU on decision-making and execution of pass and dribbling in indoor football	1 No info; Middle	7; QTNr; single data source
10.Alcalá and Garijo (2017)	Spain, TGfU, TS	Examine students’ perceptions of motivation and achievement in PE after experiencing three consecutive sport units	2 E; Middle	3x8; M; multiple data source; MQ
11.Araújo et al. (2017)	Portugal, SGA/SE, TS	Examine the impact of protocols put in place to enhance student-coaches’ pedagogical content knowledge across three seasons	1 E; Middle	20; QL; multiple data source; HQ
12.Gil-Arias et al. (2017)	Spain, TGfU/SE, TS	Investigate and compare the effect a hybrid and DIM unit, on students’ perceptions of their motivation to engage in PE	1 E; Secondary	4+4; QTNr; multiple data source; HQ
13.Harvey and García-López (2017)	USA, TGM, TS	Investigate if students could accrue MVPA recommendations in three lesson contexts of TGM	2 E; Primary and Middle	24+30; QTNr; single data source; HQ
14.Harvey et al. (2017)	USA, TGM, TS	Investigate changes in self-determined motivation of students as they participated in a GCA-basketball unit	2 E; Primary and Middle	33+ 32; QTNr; multiple data source; HQ
15.Iserbyt et al. (2017)	Belgium, PP, IS	Examine how a workshop designed for teacher promoted changes in their pedagogical content knowledge, and students’ performance as well	1 E; Secondary	6x4 QTR; single data source; HQ
16.Úbeda-Colomer et al. (2017)	Spain, TGfU, TS	Examine the student’s perceptions of a TGfU invasion games unit	1 PST+ 1 No info, Middle	8; M; single data source HQ
17.Casey and MacPhail (2018)	England, TGM/CL, No info	Provide a first empirical insight into using a models-based practice approach involving several models to teach PE	1 E, Middle	12; QL; multiple data source; HQ

18.Chiva-Bartoll et al. (2018)	Spain, TGfU/CL, TS	Examine the evolution of motivational climate through a hybrid unit	2 No info, Secondary	8; QTNr; single data source; HQ
19.Morales-Belando et al. (2018)	Spain, TGfU, TS	Verify whether pupils' performance and adherence improve after a TGfU unit	1 E, Middle	8; M; multiple data source; HQ
20.Wang and Wang (2018)	China, TGfU, TS	Investigate and compare the effectiveness of TGfU and a technical approach on MVPA levels	2 E, Middle and Secondary	12; M; multiple data source; HQ
21.Araújo et al. (2019)	Portugal, SGA/SE, TS	Analyze students' game play performance improvements across three hybrid seasons	1 E, Middle	22; QTNr; single data source; HQ
22.Bracco et al. (2019)	Canada, TGfU, TS	Investigate disengaged girls in PE, feelings about their TGfU' experiences and how the model can support their engagement	1 E.No info, Middle	6; QL; single data source; HQ
23.Farias et al. (2019)	Portugal, IGCM/SE, TS	Examine students' game performance according to the tactical structures of invasion games throughout three consecutive model-based units	1 E, Middle	20+ 16+12; QTNr; single data source; HQ
24.Gil et al. (2019)	Spain, TGfU, TS	Analyze the effect of a comprehensive questioning-based teaching program on students' decision-making	1 No info, Middle	16; QTNr; single data source; HQ
25.González-Espinosa et al. (2019)	Spain, TGM, TS	Analyze the learning differences in Basketball at TGM and DIM, as function of students' gender	1 No info, Middle	10; QTR; single data source; MQ
26.González-Villora et al. (2019b)	Spain, TGfU, TS	Compare the degree of physical and physiological performance in several TGfU and CSAM futsal units	1 E.No info, Primary and Middle	21; QTR; single data source; HQ
27.Gouveia et al. (2019)	Portugal, TGM, TS	Assess and compare the motor engagement time and the students' invasion game performance on TGM and a technique-oriented approach	2 PST + 2 E, Middle	24; QTNr; multiple data source; HQ
28.Güneş and Yılmaz (2019)	Turkey, TGM, TS	Examine the effect of a basketball TGM unit on students' cognitive, affective, and psychomotor achievement levels	1 E, Middle	12; QTNr; multiple data source; HQ
29.Koekoek et al. (2019)	Netherlands, TGfU, TS	Explore students' perceptions of video-guided debates in a game-based basketball setting	2 E.No info, No info	3; M; multiple data source; HQ
30.Özlem and Ferda (2019)	Turkey, TGM, IS	Investigate PE teachers' professional development with support of an expert	1 NT + 1E, Primary	1-year QL multiple data source; MQ
31.Rodríguez-Negro et al. (2019)	Spain, TGM, IS	Examine the effects of two different 8-week balance intervention programs	1 No info, Primary and Middle	8; QTR; multiple data source; HQ
32.Araújo et al. (2020)	Portugal, SGA/SE, TS	Examine students' game declarative understanding during a hybrid teaching unit	2 E, Secondary	24; QTR; single data source; HQ
33.Arias-Estero et al. (2020)	Southern, Europe, TGfU, TS	Explore students' game performance, knowledge, and psychosocial variables improvements with a TGfU unit	1 E, Primary	14; M; multiple data source; MQ
34.Cocca et al. (2020)	Mexico, TGfU, TS	Assessing and comparing the changes in students' physical fitness after a TGfU and a traditional program	8 No info, Middle	3x16; QTNr; multiple data source; HQ
35.García-Ceberi no et al. (2020a)	Spain, TGM, TS	Quantify and compare the external and internal charge resulting from the application of the TGM and DIM	2 E.No info, Middle	11; QTNr; multiple data source; HQ
36.García-Ceberi no et al. (2020b)	Spain, TGM, TS	Examine and compare the differences in the learning of football across two different methodologies, according to gender and football experience	1 E.No info, Middle	9; QTNr; single data source; HQ
37.García-Ceberi no et al. (2020c)	Spain, TGM, TS	Examine and contrast the differences in the learning of football across two different teaching methodologies	1 E.No info, Middle	9; QTNr; single data source; HQ
38.García-González et al. (2020)	Spain, TGfU/SE, TS	Examine whether the effects of a hybrid volleyball unit were equally effective on a set of SDT-related variables according to students' initial motivations	1 NT, Secondary	10; QTNr; multiple data source; HQ
39.Gil-Arias et al. (2020a)	Spain, TGfU/SE, TS	Compare the impact of a hybrid and MID units on students' autonomy, motivational climate, enjoyment and perceived competence	1 E, Secondary	8; QTNr; multiple data source; HQ
40.Gil-Arias et al. (2020b)	Spain, TGfU/SE, TS	Investigate the motivational outcomes of middle students as they participated in an hybrid or a DIM unit	6 E, Middle	16; QTNr; multiple data source; HQ
41.González-Espinosa et al. (2020)	Spain, TGM, TS	Characterize and compare the external training load according to the game situation in two different teaching methodologies	1 No info, Primary	10; QTNr; single data source; HQ
42.Harvey et al. (2020)	USA, TGfU, TS	Examine the effects of a TGfU unit on students' tactical knowledge development	1 E.No info, Middle	8+7+ 6+10 QTNr; single data source; HQ
43.Rodríguez-Negro et al. (2020)	Spain, TGM, IS	Examine and compare the effects of DIM and TGM	1 No info, Primary and Middle	8; QTNr; multiple data source; HQ
44.Sgrò et al. (2020)	Italy, TGM, TS	Assess the effect of two different PE teaching strategies on students' affective domain	1 E, Secondary	18; QTNr; multiple data source; HQ
45.Batez et al. (2021)	Serbia, TGfU, TS	Investigate the effects of the TGfU on students' volleyball skills and enjoyment	1 No info, Secondary	12; QTR; multiple data source; HQ
46.Gil-Arias et al. (2021)	Spain, TGfU/SE, TS	Analyze the effects of a hybrid volleyball unit on students' motivation	1 No info, Secondary	10; M; multiple data source; HQ

Legend: SGA: Step-Game Approach; IGCM: Invasion Games Competence Model; TGfU: Teaching Games for Understanding; PP: Play Practice; TGM: Tactical Games Model; SE: Sport Education; CL: Cooperative Learning Model; TS: Team Sport; IS: Individual Sport; E.NM= Experient teacher but the authors not mentioned how many years of experience; PST= Pre-service teacher; NT: Novice teacher; E= Experient teacher with > than 5 years of experience; QL- Qualitative; QT- Quantitative; QTD- Quantitative descriptive; QTR- Quantitative randomized controlled trials; QTNr- Quantitative non-randomized; M- Mix-methods; HQ: High quality; MQ: Medium quality

Table 2. Main findings of the included studies (n=46)

Study	Main findings
1.	Boys and girls progressed from the pre to pos-test, with such improvements remaining during the retention. The students with low skill level revealed large increases
2.	The hybrid unit promoted improvements on game performance and understanding and increased the correlation between both variables
3.	Students' perceptions revealed considerably variability in the building of conceptual meanings
4.	Six structures of knowledge were identified in the teachers' speech, all of them showing similar patterns
5.	Students from the experimental group enhanced their metacognitive behaviors
6.	Through TGM students can accumulate VPA levels aligned with the national guidelines. Boys showed higher MVPA/VPA levels than girls
7.	There were observed significant improvements in the movement to the basis but not in decision-making and abilities execution. For teachers, the small-sided games were important in both models, but TGfU it was hardest to implement
8.	Is possible to learn how to use the TGfU if the teacher has sufficient time and an adequate context
9.	Students without previous experience improved significantly on decision-making; Experienced students did not display significant differences at any variable
10.	Experimental group: > motivation and performance; Control group: > engagement and practiced more extracurricular activities; Students with good academic results: > participation on sport activities
11.	The interventions supported the development of students-coaches pedagogical content knowledge, enabling a full transference of instructional responsibility from teacher to students
12.	The hybrid unit promoted significant improvements on autonomy, competence, and enjoyment. There were not found significant differences within the group 1 (hybrid model) concerning motivation, relatedness, and the intention of being physically active
13.	All students had high levels of MVPA during game-based activities, but none of them achieved national PA recommendations
14.	Time had an important effect on meeting students' needs and on their self-determined motivation. Most of the class time was dedicated to game situations and the main teachers' behaviors were instruction, management, specific observation, corrective feedback, and modeling
15.	The teacher's PCK and students' performance were significantly different after the workshop. Teachers presented higher counts of descriptions, cues, specific feedback, and correct demonstrations. Students of the experimental group performed higher percentage of correct trials
16.	The students highlighted: the comprehensive approach in which the tactical principles were explained, the opportunity to create and play their own games, and the pleasant experience. Students who did not attend extracurricular sports and girls found TGfU more fun, pleasant, interesting, and understandable
17.	Teacher' frustration occurred by his progression has not happened as fast as he would like. His main difficulty was his inability to (re)conceptualize teaching
18.	Significant differences were found between the two scales regarding the perceived motivational climate
19.	Students improved on decision-making, technical execution, coverage, support, performance, game involvement, pleasure, perceived competence, and intention to be physically active
20.	Both groups showed significant improvements on MVPA levels, although the time of practice in MVPA of the TGfU group has been significantly higher. No significant differences were found between high/low skill students
21.	All students improved their performance from the first experience to the last one
22.	The students revealed a high participation and effort, learning, friendliness, and motivation. However, they had doubts about the time and choice of sports games
23.	There were found significant improvements in handball and football game performance; the correlations between the indexes analyzed increased over time
24.	Students who the questioning strategy was applied improved their decision-making in relation to the students who this strategy was not applied
25.	After the program, all students (boys and girls) of the TGM significantly improved their performance
26.	The physical and physiological performance was significantly higher in CSAM. The relationship between the physical and physiological variables helped teachers to adapt the lessons to the context
27.	There were no differences on the effectiveness of the approaches, both promoted off- and on-the-ball movement. However, students in the TGM had better on-the-ball decision-making and more motor engagement time
28.	Within both groups: there were found a significant difference in the post-test in the cognitive and psychomotor domain; When comparing both groups: although they had been detected differences in favor of TGM group in decision making, support, participation and game performance, the differences were not significant
29.	There were observed low accuracy and percentages of agreement with respect to tactical' judgements. No group differences were revealed, but students of the video-guided group increased shared understanding
30.	The PE teachers were actively involved in the process of learning and implementing TGM
31.	The static and dynamic balance improved in both intervention programs (DIM was more effective in students of year 2, 7-8 years; and TGM in students of years 4-6 and 9-12)
32.	All students improved in the tactical content taught
33.	Although there were improvements, there were not found significant differences
34.	The experimental group had significantly higher scores on flexibility, sit-ups, speed, handshake, lower limb power and cardiorespiratory capacity
35.	The TGM group achieved higher values of internal charge and spent more time in high intensity activities; boys achieved higher external and internal charge and ratings of perceived exertion values than girls
36.	Both programs promoted improvements, although the TGM provided a higher level of learning. The experience of the students had effects on some play actions
37.	Both programs promoted improvements, although the TGM provided a higher level of learning. The experience of the students had effects on some play actions
38.	Although the hybrid unit was effective in improving SDT- related variables in the three profiles identified, a large effect size was observed in profiles with a "moderate" or "low" Relative Autonomy Index
39.	During the TGfU/SE unit, students had significantly higher mean scores for interest, contribution of athletes, autonomous behavior, perceived competence, and pleasure
40.	The hybrid unit promoted higher levels of motivation, autonomy-supportive, inclusion, equitable learning environment, engagement, enjoyment, and social interactions

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41. Students of the TGM: obtain higher values of external training load, that decreases when the complexity of the game situation increases; reached the PA goals recommended by the World Health Organization
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42. TGfU was effective in developing adaptations to long-term memory, improving the quality of tactical knowledge
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43. There were found significant differences between the two models in perceived effort, PA level and in the relationship between instruction time and active learning
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44. TGM group: obtained higher scores of pleasure and climatic dimensions; Control group: obtained higher levels of ego and negative level of pleasure
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45. TGfU was effective on improving volleyball skills. The importance of enjoyment during the classes was noted
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46. Girls' perceptions of need-support, basic psychological needs satisfaction, novelty and intrinsic motivation increased largely
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Legend: TGM: Tactical Games Model; TGfU: Teaching Games for Understanding; VPA: vigorous physical activity; MVPA: moderate-to-vigorous physical activity; PA: physical activity; CSAM: Contextualized Sport Alphabetization Model; PE: Physical Education; DIM: Direct Instructional Model; SDT: Self-Determination Theory; SE: Sport Education.

Results

Globally, 46 studies met the inclusion criteria and were included in the systematic review. Next, it will be presented in detail the outcomes regarding the studies' context (Q1), main purposes (Q2), participants (Q3), methodological procedures (Q4) and main research findings (Q5).

(Q1) Which contexts have been mostly researched?

Following the recommendations of Harvey and Jarrett (2014), information about the context of the research studies is provided, so that readers are better placed to assess the claims made by authors in the various studies. The studies tended to examine a single model (72%), in alternative to hybrid combinations (28%), with TGfU (39%) being the most investigated model, and TGfU/SE (11%) the most researched hybrid combination. In relation to the type of sport/activity, team sports were largely far more investigated (83%) than individual sports (13%) and two studies (4%) did not state what activity was being taught. Of further significance is the absence of any studies where GS was implemented in the PE context and the identification of only six studies (13%) involving the SGA (9%) and the IGCM (4%), all combined with the SE. Additionally, it was observed an increase in the number of GCAs publications over the last 6 years. Spain had the greatest number of articles published (41%).

(Q2) What have been the main purposes of the conducted research?

As a result of the thematic analysis process, the research goals of the reviewed studies were organized in six different topics: 1) comparative analysis of technical and tactical approaches (37%) (e.g., Wang & Wang, 2018); 2) knowledge outcomes and game performance assessment (24%) (e.g., Araújo et al., 2019); 3) teachers' and students' perceptions of GCAs (15%) (e.g., Koekoek et al., 2019); 4) students' attitudes (motivation, engagement, adherence) (13%) (e.g., Gil-Arias et al., 2021); and 5) physical activity and fitness levels (4%) (e.g., Harvey et al., 2016). It is worth mentioning that 3 studies (7%) (e.g., Morales-Belando et al., 2018) aimed to analyze several dimensions at once (e.g., knowledge, performance, and psychosocial variables), fitting in two or more different topics. These studies were grouped in a separate topic (i.e., 6, various). The comparative analysis of technical and tactical approaches was the predominant focus and involved the comparison of students' motivation, enjoyment, autonomy, perceived competence, and effort; motor engagement time; physical, physiological, cognitive, and affective responses; game performance and game-skills learning. Nevertheless, almost half of these studies (47%) compared students' physical (e.g., distance, speed, power) and/or physiological performance (e.g., metabolic, neurological, cardiovascular systems responses).

(Q3) Who have been the researched participants?

The participants in the selected studies were mostly experienced in-service teachers (63%). Only two studies (4%) investigated the teaching practice of pre-service teachers (e.g., Gouveia et al., 2019) and other two studies (4%) examined novice-teachers (e.g., García-González et al. 2020). No information has been provided on teachers' experience in the remaining studies (29%). The middle school grade (5th-9th) was the most research setting (52%).

(Q4) Which have been the prime methodological procedures employed?

A total of 62 teaching units were investigated in the selected articles. The studies showed a tendency for implementing a single teaching unit (83%), with short-term data collection protocols (i.e., unit length inferior to nine lessons (50%)), and adopting quantitative (66%), qualitative (17%), and mix-methods (17%) analysis. The non-randomized control trials (quasi-experimental research designs) were frequently preferred (52%). Additionally, the use of multi-method (i.e., various data collection sources) and single data collection were used in the same way (50%). The most widely used instruments to collect data were systematic observation instruments (quantitative research: 35%) and interviews (qualitative: 28%; mixed methods: 59%).

(Q5) What are the main research findings?

The results of studies on topic 1 (comparative analysis of 'technical approaches' vs GCAs) showed no clear superiority of one approach over the other. Students learning sports through GCAs showed improvements in several dimensions: autonomy; perceived competence; enjoyment; pleasure; motivation; inclusion; engagement; social interactions; performance; interest; on-the-ball decision-making; higher scores on flexibility, sit-ups, speed, handshake, lower limb power and cardiorespiratory capacity; physical activity levels; high motor engagement time and high intensity activities (e.g., Cocca et al., 2020). However, there were no superior benefits of student participation in GCAs in the analysis of decision making, skill execution, motivation, intention of

being physically active, game performance and involvement variables (e.g., Güneş and Yılmaz, 2019). Both approaches seem to significantly improve moderate and vigorous physical activity levels (the values of boys are greater than the girls), static and dynamic balance, off- and on-the-ball movement, the cognitive and psychomotor domain (e.g., Wang and Wang, 2018). PE teachers considered the small-sided games equally important in both approaches (tactical and technical) and felt that GCAs are harder to implement (Nathan, 2016). Topic 2 (knowledge outcomes and game performance assessment) showed evidence of students' development long-term memory, tactical content knowledge and decision-making ability, and metacognitive skills (e.g., students learned how to design tactical tasks and assess their relevance) (e.g., Slater and Butler, 2015). The game-play performance assessment was addressed exclusively in studies on SGA and IGCM. There were found promoted improvements on students' game performance (game-play decision-making and skill-execution), especially in lower-skilled students and there was developed a positive correlation between students' game performance and understanding (e.g., Farias et al., 2019).

Studies in topic 3 (teachers' and students' perceptions of GCAs) showed that the participation in GCAs impacted positively on students' enjoyment and motivation for participating in sport-based PE activities, particularly in girls and students not participating in extracurricular sport activities (e.g., school sport) and students valued the explanations given about tactical principles and the opportunity to create and play their own games (e.g., Úbeda-Colomer et al., 2017). Teachers stressed that the successful implementation of GCAs requires time and adequate support of other peer-teachers and GCAs specialists. Moving beyond traditional teaching practices associated with the way these teachers were socialized into sport and PE (occupation socialization) was the core barrier to their self-determined, bona fide adherence to GCAs (e.g., O'Leary, 2016). In studies included in topic 4 (students' attitudes: motivation, engagement, adherence), the high amount of lesson time dedicated to the practice of small-sided games was decisive in promoting students' self-determined participation in the PE activities with significant impact on their motivation, participation, effort, learning, friendliness, and high enjoyment (e.g., Gil-Arias et al., 2020).

In topic 5 (physical activity and fitness levels) results were unclear on whether GCAs could help students accumulate vigorous physical activity levels which were aligned with national (EUA) recommendations, while boys showed higher moderate/vigorous physical activity levels than girls (e.g., Harvey et al., 2016). Topic 6 (various) showed improvements in most studies on students' decision-making (especially those without previous experience of GCAs), technical execution and performance. With respect to psychosocial variables, they were observed high levels of game involvement, pleasure, perceived competence, and intention to be physically active (e.g., Morales-Belando et al., 2018).

Discussion

The purpose of this study was to examine the findings derived from PE teachers' implementation of six GCAs (TGfU, TGA, SGA, IGCM, GS and PP), and their hybridizations. The findings of the 46 selected articles revealed that there is no clear superiority of GCAs over the technical approaches, or vice-versa. When combined with other instructional models (i.e., hybrid implementations), the SGA and IGCM favored the development of students' game performance (game-play decision-making and skill-execution) and understanding, while the TGfU had a positive impact on students' motivation, enjoyment, interest, and pleasure. Empirical evidence draws attention to the difficulties experienced by teachers in the implementation of GCAs.

Typically, studies investigated the impact of a single teaching model on students learning outcomes in greater extent (e.g., TGfU, Batez et al., 2021) than the hybridization approaches (e.g., TGM/CL, Casey and MacPhail, 2018). The TGfU was the most investigated model (e.g., Koekoek and Knoppers, 2015), which corroborates the trend found in Stolz and Pill (2013), Harvey and Jarret (2014) and Barba-Martin et al. (2020). This suggests that, while most sport practitioners (e.g., teachers, coaches, researchers) recognize the potential of GCAs for developing students' learning and engagement in sports, they prefer to structure the teaching of games in reference to more transversal and generic tactical principles and concepts (as per the TGfU). This also might explain why GS is not fully adopted in PE context, because it is better thought as an approach less structured than TGfU, more iterative and possibly non-linear, being open to different interpretations (Light, 2012).

Nevertheless, the contribution of hybrid models was discussed by González-Villora et al. (2019a), suggesting that hybridizations can extend the educational outcomes (e.g., the development of students' tactical performance), being considered a new, innovative, and necessary trend, important for extending the potential educational benefits stemming from student participation in model-based PE. For example, in trying to tackle a more specialized approach to sport content development, both SGA and IGCM were jointly applied with SE (hybrid implementation) to promote students' development of game-play performance and/or tactical knowledge in team sports (e.g., Araújo et al., 2020; Farias et al., 2019). The findings suggest that the specific features of each model, the role playing and persistent learning-teams practice of SE, and the tactical-focused team strategy building and participation in small-sided games of SGA (Araújo et al., 2020) and IGCM (Farias et al., 2015), contribute to generate positive learning outcomes. Although it is suggested that such model hybridization may concur for the achievement of a wider range of educational outcomes than the isolated use of single instructional models (González-Villora et al., 2019a), limited research has been conducted on such settings (13 hybridizations in a total of 46 articles) (see also Silva et al., 2021). Thus, additional research is needed to broaden the

understanding of how, explicitly, students can further pedagogically benefit of their participation in hybrid model-based approaches in PE.

When compared to prior reviews of GCA (e.g., Miller, 2015), the pervasive popularity of team sports (e.g., football, volleyball, handball, or basketball), and consequent lack of studies in individual sports, was verified. This finding aligns with research in community-based sport (for example, the systematic review conducted by Ramos et al. (2020) also found residual research in individual sports, only 4 in 58 studies). In this sense, to fully harness the educational potential of youth participation in GCAs, a higher focus should be placed on students' personal and performance development in individual sports (e.g., badminton, athletics, swimming). Most studies were conducted in Spain. In comparison, and this result must be carefully analyzed because the inclusion criteria of the articles are slightly different from those implemented in previous GCA reviews, a significant increase of studies conducted in Europe was previously identified (Harvey and Jarret, 2004), and it is now confirmed. In fact, 34 of the included studies (76%) were conducted in Europe. Traditionally, GCAs research has been predominantly carried out in the USA (Oslin and Mitchell, 2006). Yet, over the years, it has been extended to many countries and continents (e.g., Malaysia: Nathan, 2016; Portugal: Araújo et al., 2017; China: Wang and Wang, 2018; Turkey: Güneş and Yılmaz, 2019). Future research should continue to invest in the multicultural analysis of GCAs implementation to broaden the comprehension of its educational impact under new cultural and social circumstances.

Although it has been extensively argued that practice-referenced research (i.e., ascertain the extent to which each model explicitly develops what it was designed to develop, Kirk and Haerens, 2014) might be more beneficial to a deeper understanding of students' game-play and knowledge development in sports (Oslin and Mitchell, 2006; Harvey and Jarret, 2014), most studies continue to compare two distinct teaching perspectives (tactical approach vs traditional teaching). This contention is reinforced by the continued lack of clarity as to the superiority of one approach over the other (e.g., García-Ceberino et al., 2020c). Studies that effectively can contribute to the comprehension of the teaching and learning process of GCAs (e.g., studies with an intervention focus; Araújo et al., 2015; Özlem and Ferda, 2019) are therefore much needed. These studies could benefit, for example, from action-research designs. Action-research displays a cyclical and reflexive nature that provides practitioners the possibility to continually improve their teaching effectiveness through responsive planning, acting, finding, and re-planning, supported by ongoing data collection (evidence-based) (Kemmis et al., 2014). In turn, such process generates enhanced self-understanding of teaching practices with positive effects on students' achievement of educational outcomes (Huang, 2010).

Most of the studies gathered to this review focused on experienced teachers than on preservice or novice PE teachers. Some teachers struggled to buy-in into the GCAs pedagogies (O'Leary, 2016) as it seems to clash with their occupational socialization experiences. Most teachers were previously 'exposed' to teacher-centered/technique-focused approaches, both in their PE experiences and participation in community-based port (e.g., O'Leary, 2014). This seems to be aggravated by the concomitant difficulty that teachers feel in the application of tactical-focused instruction as they struggled to effectively apply high-order, tactical-focused instruction, questioning and feedback (Wang and Ha, 2013), and progressively design appropriately small-sided games (Stran et al., 2012).

These concerns arise in close interplay with the need to widen the teacher population being researched in GCAs, for marginal attention has been given to preservice or novice teachers who try to implement GCAs (a pervasive gap also found in prior research, e.g., Miller, 2015). This would be of the utmost importance as novice teachers have no on-site external support from GCAs specialists who might guide them throughout their lived challenges. Furthermore, the strong investment in developing knowledge of the PETE means better prepare future teachers (preservice teachers) for an effective implementation of model-based PE, a fundamental pathway for curricular renewal of PE (Silva et al., 2021). This process might be even more challenging in the case of hybrid model-based PE (e.g., SE/GCAs; CL/GCAs). Not only teachers are called to wisely manage the transfer of responsibility and leadership of learning activities to students (e.g., teacher mediation of peer-teaching tasks) (Silva et al., 2021), they also need to skillfully design collaborative problem-based interactions between students while meeting high standards of movement and sport-skills mastery (Hastie and Mesquita, 2016). Such pedagogically challenging scenario may explain the persistent scarcity of research on hybrid approaches, largely because of the high level of commitment, training, and teaching experience it requires from teachers (González-Villora et al., 2019a).

As a potential means to facilitate this aspiration, professional development and PETE protocols should be designed to provide ongoing support to pre-service and in-service teachers, through forth and back debate and interaction between university experts and PE practitioners. Such procedure could help teachers to overcome their teaching problems, on a day-by-day basis, and may unveil unique knowledge on how to effectively support teacher implementation of GCAs in schools (O'Sullivan and Deglau, 2006).

Middle and secondary students were the most predominantly investigated participants (as seen in Oslin and Mitchell, 2006, Harvey and Jarret, 2014 and Miller, 2015). However, teaching sports through contextualized game-play situations is crucial both in primary and middle education, and thus, research should increase its focus on the implementation of GCAs with children at young ages. Especially because the nature of the early sport-based physical activity experiences lived by children is a strong predictor of their future disposition to participate

in PE and out-of-school physical activity (Biddle et al., 2004), research should uncover how to best provide meaningful educational experiences to primary school students through GCAs.

From a methodological point of view, the length of the studies was mostly short-term (ranged from three lessons Koekoek et al., 2019, to one year, Özlem and Ferda, 2019), with most studies including single teaching units (e.g., Gil-Arias et al., 2021) in alternative to multiple-unit implementation (maximum: five units, Harvey et al., 2020). In some cases (e.g., Koekoek et al., 2019) students' feelings of frustration and the perception of low development of game-play ability may be consequence of the short-term length of the implemented GCAs units. In contrast, longer learning units (e.g., 18 lessons based on TGfU; Wang and Ha, 2013) allowed students to experience fun and fostered their intellectual development. Furthermore, longer learning units with an intervention focus (e.g., action research, Özlem and Ferda, 2019), allowed an active involvement of the novice-teacher during their learning process on how to effectively use the TGM. While at the beginning of the process the teacher expressed his anxiety, by felling as a student who was learning a pedagogical innovation, his professional development process progressed as the teacher achieved greater conceptual clarification and was able to solve the daily problems of his practice. In this sense, future research could benefit from longitudinal intervention-based study designs (Silva et al., 2021).

Most of the reviewed studies employed quantitative research methods (e.g., González-Espinosa et al., 2019), which is not consistent with previous findings in the GCA research where qualitative and mixed-methods data collection were prominently applied (Oslin and Mitchell, 2006; Harvey and Jarret, 2014; Miller, 2015). Nevertheless, in a recent study conducted by Barba-Martín et al (2020), the authors suggested that knowledge on GCAs can be flexibly built through different research methods (i.e., qualitative, quantitative, and mixed).

Most of the studies included in this systemic review used multiple data collection tools (e.g., Gouveia et al., 2019). Different validated instruments were used to assess game-play invasion sports, mostly systematic observation instruments (e.g., the Game Performance Assessment Instrument (GPAI) (e.g., Araújo et al., 2019); the Game Performance Observation Instrument (Farias et al., 2015); the Game Performance Evaluation Tool (Pizarro et al., 2016); the Observation of Fitness Instruction Time instrument (Harvey et al., 2017)). Although the assessment of tactical-technical learning components has been the focus of attention of teachers and researchers (Morales-Belando et al., 2018), the tactical analysis has been challenging due to the lack of knowledge about this topic (Barquero-Ruiz et al., 2019). For example, the GPAI was the most widely used observation instrument, likely due to its potential to: capture students' ability to solve game-play problems; and to keep an assessment-instruction alignment, whereby the tactical content addressed by teachers in the GCAs-based lessons is explicitly assessed (Memmert and Harvey, 2008). However, the instrument does not capture, at least directly, collective tactical dynamics emerging during student participation in sports.

As advocated by Barquero-Ruiz et al. (2019), it is urgent to use validated instruments that consider the context and content of analysis, which could facilitate the adjustment of the teaching-learning process to support students, in individual and collective fashion, as well as improve their performances. In agreement, future research is advised to resort to more advanced technology, typically employed in ecological dynamics frameworks that strongly interface with the GCAs core developmental aims (small-sided games, representativeness, and modification of tactical tasks). This would provide enhanced insight of the potential development of more complex tactical dynamics in GCAs (e.g., the team synchronization and team passing networks) (see, for example, Ramos et al., 2020).

Conclusions

In conclusion, although the comparative analysis of 'technical approaches' with GCAs showed no clear superiority of one approach over the other, numerous studies reinforced the potential of GCAs interventions to develop students' tactical knowledge and game performance, physical activity levels, as well as to increase the students' motivation for participating in PE activities. Through this review, it was not our intention to prove that one approach is better/worst than another, but reinforce the idea that multiple teaching approaches are capable of promoting learning outcomes, meaning that teachers need to know how to use different instructional models. To enhance the potential of GCAs, teachers should be encouraged and supported by PETE and professional development programs that can provide continual and on-site support during teachers' implementation of GCAs. This would allow to help teachers overcome their teaching shortcomings to solve the real-life problems of their praxis. Critical avenues for future research included to: 1) conduct more research on the SGA, the IGCM, the PP and the GS; 2) implement hybrid pedagogical approaches; 3) expand research into individual sports; 4) use pre-service, novice PE teachers and primary students as study participants; 5) investigate the processual phenomenon of teaching and learning tactics and sports in PE; and 5) to use longitudinal intervention-based study designs.

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