This is a peer-reviewed, accepted author manuscript of the following article: Morales-Belando, M., Kirk, D., & Arias, J. (Accepted/In press). A systematic review of teaching games for understanding intervention studies from a practice-referenced perspective. *Research Quarterly for Exercise and Sport*.

A Systematic Review of Teaching Games for Understanding Intervention Studies from a Practice-Referenced Perspective

Abstract

According to the theory of practice architecture, every practice enacted in classrooms is a result of interaction between social, physical and spatial elements. In relation, from a practice-referenced perspective, it is necessary to know which teaching-learning implementation features could help teachers/coaches/researchers to assemble Teaching Games for Understanding (TGfU) interventions in relation to the institutional environment. **Purpose:** This review aimed to explore from a practice-referenced perspective how TGfU researchers reported their interventions based on the teaching-learning implementation features (intervention design as a function of the context, intervention length, lesson content, basic lesson elements, lesson alignment, teacher/coach experience with the approach, and lesson validation and treatment verification) and their association with learners' outcomes. **Results:** We found 20 studies that included some of the teaching-learning implementation features, but none of the studies included all of these features. We also found that studies of TGfU measured and reported learners' outcomes in a variety of ways. This creates difficulties for drawing conclusions about the relationships between the presence of teaching-learning implementation features and student learning outcomes. **Conclusion:** Further TGfU interventions should be planned to consider the following: (a) that lessons need to be designed as a function of the context; (b) the number of intervention lessons, their duration and the duration of each lesson task; (c) the concrete tactical and technique contents and goals per lesson; (d) the modified games, questions and achievable challenges as basic lesson elements; (e) the alignment between the basic lesson elements and the structure of lessons, based on the goals of each lesson; (f) that teachers/coaches need to have previous

experience in TGfU and be trained on the specific study purpose; (g) that lessons should be validated before implementation and verified during intervention; (h) researchers should regulate the ways in which learners' outcomes are measured and reported within TGfU studies.

Key words

Sport pedagogy, TGfU, PETE, teaching-learning contexts, youth sport

Introduction

Traditionally, physical education in the early 20th century used command style teaching and prescribed activities required by gymnastics contents (Kirk, 2010). When sport-based contents were introduced into the physical education curriculum around the mid-20th century, lessons took the form of the practice of decontextualized sports techniques, so that physical education was sports-technique based rather than sport-based. Consequently, many learners did not understand how and when to use, during the game, the sports techniques they had practiced (Turner, 1996). Given understanding is an important part of children's learning in games, they showed difficulties to play during the game (Harvey, Pill, & Almond, 2018). Thus, without the inclusion of tactical understanding of how to play games, according to Bunker & Thorpe (1982), lessons were characterised by low success experienced by a large percentage of learners, teacher-dependent learners, and boring, decontextualised drills (Bunker & Thorpe, 1982).

Under such conditions, Teaching Games for Understanding (TGfU) was born as a reaction to the technique-based approach to teaching games in secondary schools in England (Bunker & Thorpe, 1982). The TGfU approach was never intended as a prescription for what teachers might do, but as advice on the importance of modifying games to suit the learner and the inclusion of tactical decision-making alongside sport techniques (Bunker & Thorpe, 1982). However, the lack of a clearly defined practice architecture of 'sayings', 'doings' and 'relatings' associated with pedagogical models (Goodyear, Casey, & Kirk, 2017) resulted in TGfU studies showing different interpretations of the original Bunker-Thorpe 'model' (Kirk & MacPhail, 2002; Stolz & Pill, 2014). For example, while Bracco, Lodewyk, and Morrison (2019) reported the lesson content, modified games and questioning, Olosova and Zapletalova (2015) carried out an intervention without showing any of these elements.

According to the theory of practice architecture, every practice enacted in classrooms is a result of interaction between social, physical and spatial elements (Kemmis, 2012). This theory determines that the elements reciprocally condition the development of a lesson because they are

interdependent and work together to construct and constitute practice. Following the previous example and consistent with this theory, the presence or absence of lesson content, modified games and questioning, could impact what happens in the lesson and therefore the learners' outcomes. In this context, it seems necessary to explore how TGfU studies implemented their interventions from a practice-referenced framework (Kirk, 2005; Miller, 2015).

The practice-referenced framework supports the operative day-to-day basis of the TGfU teaching-learning process, as in other teaching-learning approaches, within which learning is active, self-constructed, based on learners' previous knowledge, situated, socio-related and complex (Hordvik, MacPhail, & Ronglan, 2019; Kirk & MacPhail, 2002). The practice-referenced framework states that interventions should describe the 'teaching experiment' in detail as it happens (Kirk, 2005). A practice-referenced approach to research is empirical and relates to the real-life teaching and learning setting, typically in schools and other pedagogical sites. When research is practice-referenced, it seeks to capture the authentic and ecologically valid actions of teaching-learning. According to the practice-referenced framework, researchers should disclose details of the 'teaching experiment' to ensure that their interventions have good fidelity regarding the critical elements of pedagogical models such as TGfU (Kirk, 2005; Rink, French, & Theerdsma, 1996).

As in other pedagogical models, the operative provision of TGfU is determined by the teaching-learning implementation features that support the model usage as a faithful representation of what its originators (Bunker and Thorpe) intended (Hordvik et al., 2019; Kirk, 2017). From a practice-referenced perspective, it is necessary to know which features of the implementation of the approach could help teachers/coaches/researchers to assemble TGfU interventions, taking account of the institutional (typically, school) environment (Kirk, 2005, 2017). Using deductive and inductive strategies, the teaching-learning implementation features identified in the present review were: (a) intervention design as a function of the context, (b) intervention length, (c) lesson content, (d) basic lesson elements, (e) lesson alignment, (f)

teacher/coach experience with the approach, and (g) lesson validation and treatment verification (Harvey et al., 2018; Hastie & Casey, 2014; Kirk, 2017).

To the best of the authors' knowledge, there are six published peer-reviewed reviews of game-based approaches (GBA) in the Anglophone research literature, in which TGfU studies were included. Stolz and Pill's (2014) comprehensive review aimed to outline the basis for the conceptualisation of TGfU and the advocacy of TGfU and its nuanced derivatives (e.g. Game sense, Play practice, Tactical game approach, Invasion games competency model, Tactical decision learning model). They concluded that there were differences between researchers and teachers regarding TGfU use and understanding due to the competing descriptions of the TGfU nuanced versions. Consequently, they recommended continuing investigating from the practice-referenced approach. Harvey and Jarrett (2014) reviewed the extent to which Oslin and Mitchell's (2006) suggestions about comparing approaches, assessment of game-performance, learners' tactical knowledge, and teachers' and learners' results after GBA interventions had been addressed by previous studies. Without distinguishing between TGfU derivatives, they stated that further studies should address the expansion of research (coaching contexts, TGfU nuances, tactical awareness and fitness), research designs (verification procedures and longitudinal research) and intervention practices (optimal length of teachers training). Subsequently, Miller's (2015) systematic review showed the positive associations between a GBA and learners' declarative knowledge, support, perceived competence, enjoyment and effort, highlighting that intervention volume of more than eight hours was a key feature in producing these outcomes. However, Miller analysed the risk of bias of the reviewed studies, suggesting that it was necessary to improve further GBA investigations from a methodological point of view. Kinnerk, Harvey, MacDonncha, and Lyons's (2018) review, in the competitive team sports setting, found that players' tactical awareness, decision-making and affective learning improved when modified games and questioning were effectively employed. They also reported coaches' positive feelings when they were mentored. They agreed with previous reviews that further research needed to

include validation procedures, longer interventions, mixed-method designs and description of coaches' training in the approach. Recently, Abad, Collado-Mateo, Fernández-Espínola, Castillo, and Giménez (2020) systematically reviewed the scientific literature on the effects of technical and tactical approach interventions on skill execution and decision-making. They found that tactical interventions achieved significant improvements in decision-making, but they did not find significant improvements in skill execution compared to technique-based approaches. Nevertheless, Abad et al. (2020) also confirmed the heterogeneity of interventions and the low quality of evidence within these studies. Finally, Barba-Martín, Bores-García, Hortigüela-Alcalá, and González-Calvo (2020), reviewed the scientific literature published in the last six years on the implementation of TGfU in the school context. They highlighted the benefits of TGfU mainly in terms of decision-making, skill execution and level of physical activity. In addition, they claimed longer interventions were needed in the school setting.

In summary, the previous reviews advocate the necessity of analysing the different teaching-learning implementation features of TGfU interventions. Notwithstanding, only three of the previous reviews were systematic and included the risk of bias assessment of the reviewed studies (Abad et al., 2020; Barba-Martín et al., 2020; Miller, 2015). In addition, none of the previous reviews analysed TGfU from the practice architecture and practice-referenced frameworks regarding the teaching-learning implementation features highlighted in the present review. Building on these limitations and acknowledging the complex and situated nature of teaching using TGfU, the present review aimed to explore from a practice-referenced perspective how TGfU researchers reported their interventions based on the teaching-learning implementation features (intervention design as a function of the context, intervention length, lesson content, basic lesson elements, lesson alignment, teacher/coach experience with the approach, and lesson validation and treatment verification) and their association with learners' outcomes. This review is written with a view to improve future TGfU research and empirical investigation. The identification of the conditions in which TGfU studies are carried out could

provide research-based evidence to: (a) better implement the TGfU approach in real teaching-learning contexts and (b) guide future TGfU studies focused on the approach as the main frame of reference, without comparing with other teaching-learning approaches.

Method

The first author conducted the literature search in SPORTDiscuss and Web of Science, beginning on the 1st of July 2019. The following terms were used: (*TGfU* OR *teaching games* OR *Teaching Games for Understanding*) AND (*physical education* OR *youth sports* OR *sports*). The time period of data extraction was between the 1st of July 2019 and 8th of August 2019.

The review included articles: (a) published until July 2019, (b) written in English, (c) from double blind and peer-review journals, (d) conducted in physical education and youth sports (up to 18 years old) and (e) designed to evaluate the educational impact of TGfU interventions on learners' outcomes. The review excluded other types of research documents such as: (a) books, (b) reviews, (c) dissertations, (d) conferences, (e) one-page supplements and (f) other documents not written in English. Pre-service/in-service teachers' or coaches' education studies, as well as studies that included hybridisation of TGfU, were also excluded. Moreover, peer reviewed pedagogical articles (neither experimental nor non empirical) were excluded.

The systematic review was undertaken in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff, & Altman, 2009). The flow of studies through the review process and the reasons for exclusion are shown in Figure 1. In total, 540 articles were retrieved from the database search and an additional 6 articles were identified through reference lists (authors 1 and 3). Then, 23 articles were excluded due to duplication (author 1). After that, 503 articles were omitted after full-text examination because the studies did not meet one or more of the inclusion criteria (author 1 and 3). At the end of the screening procedure, 20 articles remained for the systematic review (Table 1). Disagreements over inclusion and exclusion of articles were resolved by consensus between

two investigators (authors 1 and 3). In case of doubt about including a study, the three authors made a consensus decision.

For the systematic review, the authors assessed the quality of the included studies using the Cochrane risk of bias tool (Higgins et al., 2011; Lundh & Gøtzsche, 2008). Following the Cochrane Handbook for Systematic Reviews, the five domains of bias appraised were: (a) selection bias, (b) detection bias, (c) attrition bias, (d) reporting bias and (e) other bias. Each article was scored in each item as low (+), high (-), or unclear (?) risk of bias. Studies were considered low risk of bias when all domains were scored as low risk of bias or if one item was scored as high risk or unable to determine. If two domains were scored as high or unable to determine risk of bias, the study received a moderate risk of bias. Finally, when more than two domains were scored as high risk of bias, the study was regarded as possessing a high risk of bias.

The authors focused on the seven teaching-learning implementation features determined according to the present review purpose (Table 1): (a) intervention design as a function of the context (participants' background, school/club characteristics, country characteristics), (b) intervention length (intervention hours, duration of the lesson tasks), (c) lesson content (specific content per lesson, specific goal per lesson), (d) basic lesson elements (modified games, questions, challenging tasks), (e) lesson alignment (structure of the lessons), (f) teacher/coach experience with the approach (previous experience, training on purpose), and (g) lesson validation and treatment verification. These teaching-learning implementation features were determined inductively from the practice-referenced framework (Hastie & Casey, 2014; Hordvik et al., 2019; Kirk, 2005; Kirk & MacPhail, 2002; Kirk, 2017) and deductively after the full-text examination of the 20 included articles, as result of their relevance on the teaching-learning process using TGfU. Table 1 shows the presence (+), absence (-) or lack of information (?) of each teaching-learning implementation feature analysed. From this table, findings are presented in the result section by mean of counts and percentages of numbers of articles in which each

teaching-learning implementation feature occurred over the total amount of articles found. In addition, we used Spearman's Rho correlation coefficient and logistic regression analysis in order to provide a deep representation of how the presence of teaching-learning implementation features impact on learners' outcomes. We categorized the presence of teaching-learning implementation features as a dichotomous variable (yes/no) and learners' outcomes into magnitude of effect sizes.

Results

Risk of bias

For the systematic review, almost half of the assessed articles were at moderate risk of bias (n = 9, 45%; Table 2). In general, these results matched those from low risk of bias or unclear score presented in selection and attrition bias. Thirty-five percent of the assessed articles were at low risk of bias (n = 7). Overall, these articles performed a complete outcome (attrition bias), blinding outcome (detection outcome) and properly selective reporting (reporting bias). The main weakness was random selection (selection bias). Finally, only four studies were at high risk of bias (20%). Three of them presented high risk of reporting bias, four were unclear in terms of detection and attrition bias and three were unclear on selection bias.

Overview of studies

The majority of the included articles involved the investigation of invasion games (n = 17; 85%), comparing teaching-learning approaches (n = 11; 55%). The most analysed game was field hockey (n = 7; 35%). The interventions were mostly implemented in the school context in physical education classes (n = 16; 80%), with an intervention exposure between 5.5 (Morales-Belando, Calderón, & Arias-Estero, 2018) and 29.3 hours (Hortigüela & Hernando, 2017). The number of study participants ranged from six (Bracco et al., 2019) to 237 (Hortigüela & Hernando, 2017). The mean of participants was 54 boys (between five and 225) and 36 girls (between six and 103). The participants' mean age was 11.80 years (*SD* = 2.11; range between eight and 18). Game-performance outcomes were assessed in 13 studies (65%), knowledge

outcomes in 10 studies (50%), psychological outcomes in 11 studies (55%) and physical activity outcomes were measured in two studies (10%). The majority of the studies followed a quantitative research design (n = 12, 60%) and six a mixed-method design (30%). Fifteen of the studies carried out a pre-post assessment (75%) and 15 used a control group (75%).

Intervention design as a function of the context

Although 55% of the studies provided information about the context (n = 11), only 20% designed the interventions as a function of the context (n = 4). Specifically considering those 55% studies mentioned, 50% reported information about participants' previous background (n = 10), 20% regarding the school/club characteristics (n = 4) and no studies about the country's characteristics (Table 1).

Intervention length

Thirty percent of the studies conducted a short intervention of eight lessons or fewer (n = 6), whereas 60% of the studies showed a longer intervention of more than eight lessons (n = 12) and 10% of the studies did not show this datum (n = 2, Jones, Marshall, & Peters, 2010; Koekoek & Knoppers, 2015). However, considering the hours of learners' exposure, 35% of the studies reported an intervention duration of eight hours or less (n = 7) and 50% of more than eight hours (n = 10, Table 1).

Lesson content

The content taught in the intervention lessons appeared in 55% of the studies (n = 11, Table 1). Thirty percent of the studies showed tactical and technique contents (n = 6), 20% only identified tactical content (n = 4), and one study did not differ between tactical and technique contents (Balakrishnan, Rengasamy, & Aman, 2011). Furthermore, 30% of the studies detailed the content per lesson (n = 6) and only 20% specified the goal per lesson (n = 4, Table 1).

Basic lesson elements

The majority of the studies reported modified games (n = 15, 75%), questions (n = 13, 65%), and challenging tasks (n = 11, 55%, Table 1). In particular, 55% of the studies showed examples of

modified games (n = 11). Nevertheless, only 35% of the studies explained how to design challenging tasks (n = 7) and 25% reported examples of questions (n = 5).

Lesson alignment

The results showed that only 35% of the studies aligned the structure of the lessons, modified games, questions and challenging tasks, based on the goals of such lessons (n = 7, Table 1). However, 70% of the studies reported the structure of the lessons (n = 14). Specifically, Metzler's (2005) structure of the lessons was the most utilised (n = 5, 25%), whereas six studies did not present the structure of the lessons (30%, Table 1).

Teacher/coach experience with the approach

Twenty percent of the studies did not report on teacher/coach experience and training in TGfU (n = 4). Fifteen percent included teachers/coaches with previous experience in TGfU (n = 3, Bracco et al., 2019; Koekoek & Knoppers, 2015; López et al., 2016). Thirty percent trained teachers/coaches in TGfU (n = 6) and 35% of the studies counted on teachers/coaches with previous experience who were also trained on purpose, specifically for the study (n = 7, Table 1).

Lesson validation and treatment verification

On the one hand, thirty percent of the studies reported the validation procedure of the lessons (n = 6, Table 1). Fifteen percent validated the lessons asking TGfU experts (n = 3, Morales-Belando & Arias-Estero, 2017a, 2017b; Morales-Belando et al., 2018), 10% used a validation protocol (n = 2, Turner, 1996; Turner & Martinek, 1999), and 5% piloted the lessons prior to the study (n = 1, Jones et al., 2010). On the other hand, 55% of the studies presented the verification procedure utilised during the intervention (n = 11, Table 1). Forty percent used a benchmark checklist (n = 8) and 15% discussed the expected behaviours after each lesson (n = 3, Koekoek & Knoppers, 2015; Nathan, 2013; Turner & Martinek, 1999).

Association between teaching-learning implementation features and learners' outcomes

The results showed no correlation between the presence of teaching-learning implementation features and game-performance, knowledge, psychological and physical activity variables ($p >$

.05). In addition, the regression models were not significant. In practical terms, this meant no predictive power of the teaching-learning implementation features in relation to learners' outcomes.

Discussion

The present review aimed to explore how selected TGfU studies reported their interventions based on the teaching-learning implementation features outlined earlier, and their relationship with learners' outcomes. Overall, we only found 20 TGfU articles, despite the increasing number of research projects in this field (e.g. Memmert et al., 2015). The quality of the studies reviewed we judged to be between high and moderate, which is an improvement in comparison with the studies reviewed by Miller (2015). However, this result regarding the number of high and moderate quality articles suggests the necessity of more investigations that provide reliable evidence about the effects of TGfU interventions (Kirk, 2005; Rink et al., 1996).

Intervention design as a function of the context

None of the previous reviews explored whether interventions were designed as a function of the context (Abad et al., 2020; Barba-Martín et al., 2020; Harvey & Jarrett, 2014; Kinnerk et al., 2018; Miller, 2015; Stolz & Pill, 2014). However, the teaching-learning process demands designing the lessons based on the participants' background, school/club and country characteristics (Hordvik et al., 2019). The teacher/coach needs to have some sense of what the learner already understands about the game because the learner self-constructs the new knowledge based on previous experience (Kirk & MacPhail, 2002). This could be why the four studies in which the interventions were designed considering the context improved the game-performance, knowledge, psychological and physical activity variables, although there were no predictive associations (Bracco et al., 2019; Koekoek & Knoppers, 2015; Turner & Martinek, 1999; Turner, Allison, & Pissanos, 2001). For instance, Koekoek and Knoppers (2015) chose baseball because it allowed students many opportunities to make tactical decisions, which matched their participants' previous experiences. Nonetheless, the lack of associations between

designing the interventions considering the context and learners' outcomes, could mean that it is not only necessary to consider the learners' lack of experience, as in Turner and Martinek (1999), but for example what they really know about what is going to be taught, as in Harvey et al. (2010).

Furthermore, the discussion from a situated learning perspective includes the institutional environment and cultural aspects, as did Koekoek and Knoppers (2015) in their study. In this respect, Harvey and Jarrett (2014) and Kinnerk et al. (2018) presented the number of studies with TGfU derivatives according to the country, but it would be interesting to know also how further studies consider the particular physical education curriculum of each country. For example, Bracco et al. (2019) aligned the unit with the provincial health and physical education curriculum. Nevertheless, the studies normally reported information mostly about the participants' background and only one study based the intervention on the participants' background, school/club and country characteristics, as national or district curricula and other aspects of the country's educational system (Bracco et al., 2019, Table 1).

Intervention length

The results of the present work showed a larger number of long-term interventions in contrast with the previous reviews (Barba-Martín et al., 2020; Harvey & Jarrett, 2014; Kinnerk et al., 2018; Miller, 2015). Specifically, the present review identified 10 studies of more than eight hours, whereas Harvey and Jarrett (2014) only found five longitudinal research design studies (Table 1). According to the small number of longer interventions studies reported in the previous reviews, they recommended longer interventions because TGfU demands that learners engage in tasks that require a higher level of thinking and reflective processes than most traditional practices in physical education (Stolz & Pill, 2014). In other words, given these TGfU tasks are more difficult for learners, from a cognitive point of view, they assumed that longer interventions were necessary. For example, Barba-Martín et al. (2020) recommended longer periods of teaching-learning activities for TGfU.

In line with this thinking, Miller (2015) showed a positive association between longer interventions of more than eight hours and game-performance outcomes. The present work also reported six studies that obtained better results in all game-performance and knowledge variables after longer interventions of more than eight hours (Hortigüela & Hernando, 2017; Morales-Belando & Arias-Estero, 2017a, 2017b; Olosová & Zapletalová, 2015; Robinson & Foran, 2011; Turner & Martinek, 1999). However, the present review also showed seven studies that found improvements in all knowledge, psychological and physical activity variables after shorter interventions of eight hours or less (Allison & Thorpe, 1997; Bracco et al., 2019; Lawton, 1989; López et al., 2016; Morales-Belando et al., 2018; Nathan, 2013; Wang & Wang, 2018). Nevertheless, there were no predictive associations between intervention length and learners' outcomes. Therefore, given both longer- and shorter-term interventions showed improvements, as in Abad et al. (2020), it seems necessary not to limit the focus on the length of the interventions but also to consider the interaction with the other teaching-learning implementation features, as well as the number of hours. For instance, Morales-Belando and Arias-Estero (2017a) controlled the duration of the lesson tasks, obtaining positive results in all game-performance and knowledge variables. Hence, although compared to the technique-based approach, the development of higher-order cognitive skills using TGfU demands higher intervention volumes (Kirk & MacPhail, 2002), it is recommended to specify the effective time of practice in each task, lesson and the entire unit rather than merely the duration of the unit overall.

Lesson content

Bunker and Thorpe created TGfU so that students learnt the tactics in relation to techniques. This means that, if the essence of TGfU demands basing the teaching of technique on tactical contents, the selection and description of such contents is crucial. However, the GBA reviews did not analyse the lesson contents of previous TGfU studies (Abad et al., 2020; Barba-Martín et al., 2020; Harvey & Jarrett, 2014; Kinnerk et al., 2018; Miller, 2015; Stolz & Pill, 2014). In contrast, the present review found that almost half of the reviewed studies did not report the contents

taught, which makes it difficult to determine whether they used TGfU for teaching tactical content (Butler, 2014). Furthermore, the majority of the reviewed studies did not detail the contents and goals of each lesson (i.e. Allison & Thorpe, 1997; Balakrishnan et al., 2011; Bracco et al., 2019; Dania et al., 2017; Hortigüela & Hernando, 2017; Jones et al., 2010; Koekoek & Knoppers, 2015; Lawton, 1989; Nathan, 2013; Olosová & Zapletalová, 2015; Robinson & Foran, 2013; Turner, 1996; Turner & Martinek, 1999; Turner et al., 2001). This lack of information indeed does not permit us to know whether the technique content was associated with tactics, which is intended to provide teachers/coaches with a point of focus for helping learners understand the purpose of the game (Kirk & MacPhail, 2002). Hence, the question is whether there is good fidelity between the TGfU approach and what the researchers did. Therefore, it is necessary that future studies emphasize the technique and tactical lesson contents.

In doing so, the TGfU interventions should focus on teaching the tactical contents, which is where the challenge lies for teachers, since as we noted in the introduction, games have most often been taught following a technique-based approach (Harvey, Cushion, & Sammon, 2015). Focusing on the tactical contents implies having knowledge about the structure of games, their shared key characteristics and the tactical principles of play. This knowledge of games is necessary to design lessons that emphasize tactical learning outcome. On this basis, for instance, Morales-Belando and Arias-Estero (2017a) conducted a TGfU study on sailing, considering the relevance of the decision-making component (due to the high level of uncertainty in sailing) based on the tactical principles of play. The tactical principles of play allow the teacher/coach to know what should be taught and establish the learning outcomes in order for learners to understand the game progressively (Kirk, 2005).

Basic lesson elements

None of the previous reviews showed results about whether studies included modified games, questions and challenging tasks as basic elements of the lessons (Abad et al., 2020; Barba-Martín et al., 2020; Harvey & Jarrett, 2014; Kinnerk et al., 2018; Miller, 2015; Stolz & Pill, 2014).

According to Kirk (2017), these three features are non-negotiable aspects of the model in order to propose a distinctive practice architecture for TGfU. Modified games are an essential resource for adapting the adult game to children's developmental levels, needs and interests, in the process exaggerating certain tactical challenges. However, six studies included modified games and did not show positive association with all the learners' outcomes (Dania et al., 2017, Harvey et al., 2010; López, Práxedes, & del Villar, 2016; Morales-Belando & Arias-Estero, 2017a, 2017b; Turner, 1996). In comparison, there were two studies that did not include modified games and showed positive association with all the learners' outcomes (Balakrishnan et al., 2011; Olosová & Zapletalová, 2015). Nonetheless, there were no predictive associations between the presence of modified games and learners' outcomes. Therefore, it seems that it is not only necessary to use modified games, but also to design the games based on tactical challenges (Harvey et al., 2018). In this sense, we recommend that functional (obligations and prohibitions) and structural (space, time, equipment, and number of players) modifications are made at the beginning of the lesson and only structural modifications at the end (Barquero-Ruiz, Morales-Belando, & Arias-Estero, in press). The game modifications may then facilitate the learners' personal interpretations based on their previous experiences (Harvey et al., 2010).

In this relationship between previous knowledge and new learning, questioning is placed in the spotlight, because questioning plays a crucial role to facilitate learners' awareness (Memmert et al., 2015). Questioning is essential to make teaching explicit and purposefully directed, promoting understanding (Harvey et al., 2018). This could be why six studies reported questions and their learners improved in all game-performance variables (Morales-Belando & Arias-Estero, 2017a, 2017b; Morales-Belando et al., 2018; Nathan, 2013; Robinson & Foran, 2013; Turner & Martinek, 1999). Nevertheless, there were three studies that showed improvements in all the learners' outcomes, although it is not possible to know whether researchers used a question-and-answer strategy (Balakrishnan et al., 2011; Hortigüela & Hernando, 2017; Olosová & Zapletalová, 2015). That the differences between the presence and

absence of questions were sparse in terms of learners' improvements, could be because questions need to be designed specifically to foster understanding about where, when, what, why, and how to play the game. In addition, questions should be planned based on learners' previous knowledge and their expected behaviours during the lesson (Kirk & MacPhail, 2002).

In congruence with questioning, if learning occurs when learners are 'thinking players' (Stolz & Pill, 2014), tasks should provide a setting of problems, such as achievable challenges to be solved by the students, as was extensively reported in some studies (i.e. Dania et al., 2017; Koekoek & Knoppers, 2015; Morales-Belando et al., 2018; Robinson & Foran, 2013). These challenges should be not too easy or too complex but adapted to learners' readiness and development levels. However, the problem resides in the fact that most of the studies did not specify how to design challenging tasks. To deal with this, some pedagogical strategies could be, for example, posing problems and setting exploratory tasks to allow learners to wrestle with problems, explore and propose solutions (Morales-Belando et al., 2018), starting each lesson based on learners' previous knowledge (Stolz and Pill, 2014), using meaningful examples as a bridge between learners' previous experience and new knowledge (Chen, Rovegno, Cone, & Cone, 2012) and introducing new questions adapted to learners' answers (Butler, 2014). Consequently, in line with a student-centred pedagogy, it is crucial to use modified games, questions, and achievable challenges that focus the tasks, facilitating a process through which learners actively make sense of new information (Kirk, 2017). For that purpose, we propose studies should show examples of modified games, questions, and strategies to design challenging tasks.

Lesson alignment

Regarding the basic lesson elements, alignment refers to the relationship between the different elements of the lesson to provide greater coherence and efficiency within the teaching-learning process (Biggs, 2014). However, according to the previous reviews (Harvey & Jarrett, 2014; Stolz & Pill, 2014) as in the present one, the studies have mainly omitted to detail how 'teaching

for understanding' took place (Harvey et al., 2018; Stolz & Pill, 2014). Building on the aligned framework from a constructivist theory of learning, the connection between modified games, questions, and challenging tasks within the structure of the lessons generates knowledge that may be more important to foster understanding and game play than merely acquiring isolated information (Vygotsky, 1978). In other words, the careful alignment of elements of the lesson, including what teachers do, supports the occurrence of learning. Aligned practice leads to faster decision-making within the game environment, even considering that off-the-ball actions are more complex to learn (Harvey et al., 2010).

In relation to the influence of alignment, the five studies that aligned the basic lesson elements showed positive outcomes in all the game-performance, knowledge, psychological and physical activity variables, although there were no predictive associations (Bracco et al., 2019; Morales-Belando et al., 2018; Turner & Martinek, 1999; Turner et al., 2001; Wang & Wang, 2018). Examining this in more depth, half of the studies that aligned the lessons utilised Metzler's (2005) five-task structure, which was generally the most used. Despite the lack of associations between lesson alignment and learners' outcomes, this greater use of Metzler's (2005) structure could be due to its potential to support alignment, considering the timetabling constraints in comparison to other structures (i.e. Bracco et al., 2019). Briefly, this structure presents two modified games in tasks one and four ('game form' and 'return to game form', respectively), one technical drill in task two ('drills for skill development') and two questioning periods in tasks three and five ('teaching for understanding' and 'review and closure', Metzler, 2005). Thus, in the first and third tasks, learners' autonomously experiment with the modified game form where game structures are adapted to the player's success. With this purpose and according to the suggestion in the previous section, in the first task, teachers/coaches should use functional and structural modifications and only structural modifications in the fourth task. In the second task, learners practise the technique content related to the tactical content, as we recommended in the lesson content section. In the third task, learners reflect on what they have to do and why with

regard to the previous tasks and the previous lessons, through the teacher/coach poses questions to make them aware of their knowledge and foster their understanding. Finally, in the last task, learners again reflect, this time on the integration and understanding of decision-making and skill execution (i.e. Dania et al., 2017; Harvey et al., 2010; Morales-Belando & Arias-Estero, 2017a, 2017b; Morales-Belando et al., 2018). This structure of the lessons could help to provide a direct bridge between modified game tasks and full games.

Teacher/coach experience with the approach

According to Miller (2015) and as was underlined in the lesson contents section, the design and implementation of TGfU interventions is not easy because changing teachers/coaches understanding of learning, assumptions and beliefs requires time and adaptation (Harvey et al., 2015). In line with Barba-Martín et al. (2020), it is necessary to invest time in teachers' previous preparation since they must master both the content and the characteristics of the approach. Addressing Harvey and Jarrett's (2014) recommendations, the majority of studies reviewed in the last decade included information about teacher/coach experience and training using TGfU (Table 1). In general, the studies showed extensive teacher/coach training procedures. For instance, Harvey et al. (2010) detailed the shortest protocol of 4.5 hours, including the establishment of each lesson's content, explanation of the approach using a video and book chapter, and resolution of questions about the approach. In contrast, Hortigüela and Hernando (2017) implemented the longest training for 30 hours, consisting of understanding pre-designed lessons from which the teacher designed the final version of the TGfU unit. Furthermore, Harvey et al. (2010) weekly specified the time schedule for each stage, whereas Hortigüela and Hernando (2017) only mention the total duration. Finally, Morales-Belando et al. (2018) mentored the teacher during his intervention, providing feedback on the TGfU pedagogical features and responding to his questions.

Notwithstanding this variety of training procedures, the reviewed studies found more positive learners' outcomes when the teachers/coaches had experience and were trained

specifically for the intervention, while there were no predictive associations (Allison & Thorpe, 1997; Dania et al., 2017; Hortigüela & Hernando, 2017; Morales-Belando & Arias-Estero, 2017a; Turner & Martinek, 1999; Turner et al., 2001; Wang & Wang, 2018). In contrast, Harvey and Jarrett (2014) emphasized that teachers'/coaches' experiences of using TGfU, together with mentoring and support, allows them to implement TGfU interventions with good fidelity. In this sense, teachers/coaches favoured the mentoring approach provided (Kinnerk et al., 2018). Nevertheless, building on the nature of TGfU, it is necessary to determine the time distribution (Butler, 2014), as well as the training themes. These themes would depend on teachers'/coaches' pedagogical background and TGfU experience. However, they should encompass those matters such as constructivism, autonomy-supporting pedagogies, game structure, their shared key characteristics, tactical principles of play, TGfU 'critical elements', questioning, expected teacher/coach and learner behaviours, and lesson design.

Lesson validation and treatment verification

Overall, the results of the present work agreed with those of the three previous reviews on the low number of studies that included validation and verification procedures (Harvey & Jarrett, 2014; Kinnerk et al., 2018; Miller, 2015). Specially, Kinnerk et al. (2018) showed that only 15% of studies presented validation measures to check the fidelity of the interventions, which was even lower than the 30% found in this review (Table 1). This result could suggest that it is impossible to know whether the interventions were implemented according to the TGfU approach, and whether the learning outcomes achieved were a result of the intervention. In general, validation is done to confirm that the lessons are designed according to TGfU 'critical elements' (Kirk, 2017), whereas verification consists of confirming that teachers/coaches' and learners' expected behaviours emerge during the intervention (Butler, 2014). The validation and verification procedures add further value to the research, which increases the quality of the studies and ensures that learners' outcomes are the result of the TGfU intervention (Harvey & Jarrett, 2014; Miller, 2015).

In this sense, the studies followed different validation procedures, ranging from the use of pilot lessons (i.e. Jones et al., 2011) to pre-establishing protocols (i.e. Turner & Martinek, 1992). Similarly, the verification procedures were extensive, ranging from discussing the expected students' behaviours with the teacher (i.e. Koekoek & Knoppers, 2015) to confirming these behaviours using Butler's (2014) Metzler's (2005) or Turner and Martinek's (1999) benchmark checklists (i.e. Harvey et al., 2010). Thus, when using TGfU, it is necessary to validate the lessons after their design and verify the intervention during its implementation. According to the broader procedures, we recommend that the TGfU 'critical elements' for validation (student-centred pedagogy, the use of modified games and the setting of problems to be solved, Kirk, 2017) are also employed, and Butler's (2014) benchmarks used for verification.

Limitations of the study regarding the association between teaching-learning implementation features and learners' outcomes

The results regarding the association between teaching-learning implementation features and learners' outcomes should be interpreted with caution due to several concerns. First, one of the difficulties of attempting to link the teaching-learning implementation features with learners' outcomes is the various different ways learning has been measured in TGfU studies. Second, no improvement in learning could be a consequence of not reporting the teaching-learning implementation features analysed in the present study. The authors could have considered some of these teaching-learning implementation features but they had not reported them in their articles. Third, student learning outcomes were categorized into magnitude of effect sizes considering only the studies that allowed us to aggregate those results. Fourth, the number of studies was low for predicting associations. According to these four concerns, investigators in this area should: (a) try to use experimental methodologies like randomized control trials or pre-post measures with control group, (b) randomize groups or the order of conditions/interventions, (c) blind the allocated interventions to outcome assessors, (d) show learners' outcomes data,

including means, standard deviation and magnitude of effect sizes, and (e) report all the expected outcomes without selecting only positive findings.

Conclusion

In conclusion, none of the reviewed studies presented information of all the teaching-learning implementation features analysed in the present review, suggesting a lack of knowledge about how to assemble the elements that revolved around the interventions with TGfU. Consequently, further TGfU interventions should be planned considering and reporting the key teaching-learning implementation features of TGfU as we have detailed them in this paper. First, interventions should be designed as a function of the context, according to participants' previous background and school/club and country's characteristics. Second, studies must inform about number and duration of intervention lessons, duration of each lesson task, and lesson content. Third, lesson contents should be determined according to concrete and associate tactical and technical goals in each lesson. Fourth, it is necessary that interventions use modified games, questions and challenging tasks, as crucial basic lesson elements for TGfU. Fifth, such lesson elements should be aligned with the goals of each lesson. Sixth, it is basic to invest time in order teacher/coach to gain experience with the approach, and therefore showing the procedures, duration, temporal distribution and mentoring carried out. Seventh, validation and verification procedures are extremely recommended to check the fidelity. Finally, researchers should regulate the ways in which learners' outcomes are measured and reported within TGfU studies. A checklist of these recommendations and those mentioned throughout the discussion section is included in Table 3 to guide researchers in order to show basic information about their TGfU teaching experiments.

What does this study add?

This article is significant in that it is the first TGfU review informed by a practice-referenced approach. The design of this study is also unique because it examined variables not tested until now such as the teaching-learning implementation features and their association with learners'

549 outcomes. In addition, the systematic review included an assessment of the quality of the studies
550 using the Cochrane risk of bias tool. In general, the review did not show associations between
551 teaching-learning implementation features and learners' outcomes because of the methodological
552 inconsistencies of reporting teaching-learning implementation features and of measuring learners'
553 outcomes. Despite the previous studies show the positive effect of TGfU, these results should be
554 checked through high quality intervention methodologies. In order to improve future TGfU
555 research and empirical testing, it is recommended that researchers plan interventions considering
556 the teaching-learning implementation features following the suggestions showed in the discussion
557 section (Table 3).

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Table 1. Summary of of teaching-learning implementation features presence in each study.

Figure 1. Study selection PRISMA flow diagram.

Table 2. Risk of bias assessment.

Table 3. Checklist to guide researchers.

Table 1. Summary of teaching-learning implementation features presence in each study.

Study	Intervention design as a function of the context	Characteristics of Participants' background	Characteristics of school/club	Characteristics of country	Intervention length ≤ 8	Intervention length > 8	Intervention hours ≤ 8	Intervention hours > 8	Duration of the lesson tasks	Specific Lesson content	Specific content per lesson	Specific goal per lesson	Specific Modified games	Specific Questions	Specific Challenging tasks	Specific Lesson alignment	Specific Structure of the lessons	Teacher/coach experience with the approach: Previous experience	Teacher/coach experience with the approach: Training on purpose	Lesson validation	Lesson verification
Allison and Thorpe (1997)	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	+	+	-	+
Balakrishnan et al. (2011)	-	+	-	-	+	-	?	?	-	+	-	-	-	-	-	-	-	?	?	-	-
Bracco et al. (2019)	+	+	+	+	+	-	+	-	-	+	-	-	+	+	+	+	+	+	-	-	-
Dania et al. (2017)	-	-	+	-	-	+	-	+	-	-	-	-	+	+	+	+	+	+	+	-	+
Harvey et al. (2010)	-	+	-	-	-	+	-	+	-	+	+	-	+	+	+	+	+	-	+	-	+
Hortigüela and Hernando (2017)	-	+	-	-	-	+	-	+	-	-	-	-	+	-	-	-	+	+	+	-	-
Jones et al. (2010)	-	-	-	-	?	?	?	?	-	-	-	-	-	-	-	-	-	-	+	+	-
Koekoek and Knoppers (2015)	+	-	+	+	?	?	?	?	-	+	-	-	+	+	+	-	-	+	-	-	+
Lawton (1989)	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	?	?	-	-
López et al. (2016)	-	+	-	-	-	+	+	-	-	+	+	+	+	+	+	-	+	+	-	-	+
Morales-Belando and Arias-Estero (2017a)	-	+	-	-	-	+	-	+	+	+	+	+	+	+	-	-	+	+	+	+	+
Morales-Belando and Arias-Estero (2017b)	-	+	+	-	-	+	-	+	-	+	+	+	+	+	-	-	+	-	+	+	+
Morales-Belando et al. (2018)	-	+	+	-	+	-	+	-	-	+	+	+	+	+	+	+	+	-	+	+	+
Nathan (2013)	-	-	-	-	-	+	+	-	-	+	-	-	+	+	+	-	+	-	+	-	+

Olosová and Zapletalová (2015)	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	?	?	-	-
Robinson and Foran (2011)	-	+	-	-	+	-	-	+	-	-	-	-	+	+	+	-	+	-	+	-	-
Turner (1996)	-	+	-	-	-	+	-	+	-	-	-	-	+	-	+	-	+	?	?	+	-
Turner and Martinek (1999)	+	+	-	-	-	+	-	+	-	-	-	-	+	+	+	+	+	+	+	+	+
Turner et al. (2001)	+	+	+	+	-	+	-	+	-	+	-	-	+	+	+	+	+	+	+	-	-
Wang and Wang (2018)	-	+	+	-	-	+	+	-	-	+	+	-	+	+	-	+	+	+	+	-	+

Note. Presence (+), absence (-) or lack of information (?) of each teaching-learning implementation feature analysed.

Table 2. Risk of bias assessment.

Study	Random sequence generator (selection bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias	Cochrane risk of bias tool
Allison and Thorpe (1997)	+	?	?	+	+	Moderate
Balakrishnan et al. (2011)	+	+	?	-	+	High
Bracco et al. (2019)	?	+	?	+	+	Moderate
Dania et al. (2017)	?	+	+	+	+	Low
Harvey et al. (2010)	?	+	+	+	+	Low
Hortigüela and Hernando (2017)	?	+	+	-	+	Moderate
Jones et al. (2010)	?	?	?	+	+	High
Koekoek and Knoppers (2015)	+	+	?	+	+	Low
Lawton (1989)	?	?	?	-	+	High
López et al. (2016)	?	+	?	+	+	Moderate
Morales-Belando and Arias-Estero (2017a)	+	+	+	+	+	Low
Morales-Belando and Arias-Estero (2017b)	+	+	+	+	+	Low
Morales-Belando et al. (2018)	?	+	?	+	+	Moderate
Nathan (2013)	?	+	?	+	+	Moderate
Olosová and Zapletalová (2015)	?	?	?	-	+	High
Robinson and Foran (2011)	+	+	+	+	+	Low
Turner (1996)	+	?	?	+	+	Moderate
Turner and Martinek (1999)	+	?	?	+	+	Moderate
Turner et al. (2001)	?	?	?	+	+	Moderate
Wang and Wang (2018)	+	+	+	+	+	Low

Note. Low (+), high (-), or unclear (?) risk of bias.

Table 3. Checklist to guide researchers.

Teaching-learning implementation features	✓ / X
Intervention design as a function of the context	
Intervention design as a function of the context	
Participants' previous background (with game, teaching model, culture aspects such as media sport)	
School/club characteristics	
Country's characteristics	
Intervention length	
Number of intervention lessons	
Duration of intervention lessons	
Duration of each lesson task	
Lesson content	
Intervention as a function of concrete tactical and technical goals (learning outcomes) and contents in each lesson	
Technique content associated with tactics	
Basic lesson elements	
Modified games	
Questions	
Challenging tasks	
Lesson alignment	
Structure of the lessons	
Modified games, questions, challenging tasks, and structure of the lessons aligned with the goals of each lesson	
Teacher/coach experience with the approach	
Procedures (training themes)	
Total duration	
Temporal distribution	
Mentoring (supporting)	
Lesson validation and Treatment Verification	
Validation measures	
Verification procedures	