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Conducting systematic reviews of applied interventions: A comment on Cabral et al. (2022)

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Abstract

In their recent systematic review and meta-analysis, Cabral et al. (2022) explored the effects of implicit motor learning under pressure conditions. As a stated focus, they aimed to address the previously inconsistent findings in the literature and provide clarity to researchers and practitioners. Although we agree that such clarity is needed, we contend that there are critical methodological and procedural concerns that prevent this systematic review from achieving its objectives. In this commentary, we lay out these specific concerns in light of recent debates in this research area and the demands of real-world sporting contexts. More generally, we also call attention to important principles to consider when planning a systematic review of interventions in order to maximise contributions to the literature and usefulness for applied psychology practice.

Keywords: Explicit Instruction, Analogy, Intervention, Methodology, Applied Practice, PICO

1 **Conducting systematic reviews of applied interventions: A comment on Cabral et al. (2022)**

2 In sport psychology, it is commonly expected that review articles not only provide a summary
3 of the current state of knowledge in a topic, but also provide a critical evaluation of existing studies,
4 including coverage of strengths, weaknesses, and conceptual/methodological limitations (see Coffee
5 & Moran, 2015). Such reviews can produce notable impact because they typically distil, scrutinise,
6 and synthesise many years of research findings, often making them useful to a wide audience (e.g.,
7 from novice students to experienced researchers and practitioners). Indeed, systematic reviews can
8 quickly acquaint and orient neophytes, generate new lines of research inquiry, and efficiently inform
9 evidence-based practice (see Ankem, 2008). To achieve this and deliver on their promise, however,
10 systematic reviews must feature a considered, methodical approach that is informed by relevant
11 literature and practice to ensure the validity of their results. For reviews of applied interventions, in
12 particular, important features typically include a reasoned and clear research question/aim, systematic
13 search terms and associated processes (e.g., PICO), appropriate inclusion and exclusion criteria,
14 rigorous assessments of quality, and consideration and analysis of any inconsistencies (Carr, 2002).
15 Without a careful and critical approach that includes such components, systematic reviews can
16 generate unproductive and misleading findings that hinder, or even obstruct, research and practice
17 (Tod et al., 2021). It is with these procedural and methodological points in mind that we comment
18 specifically on the recent systematic review of implicit learning by Cabral et al. (2022), with
19 consideration of its contribution to the literature and utility for practice, while also presenting key
20 principles to consider when systematically reviewing applied interventions in sport psychology more
21 generally.

22 **Research Question and Study Objectives**

23 As research questions determine and guide the method (e.g., setting eligibility criteria, selecting
24 the search terms, assessment of risk, and more; Thomas et al., 2019), “getting the research question
25 right is critical for the success of a systematic review” (Lasserson et al., 2019, p. 4). In their article,
26 Cabral et al. followed commonplace conventions in systematic reviews (e.g., making methods and
27 data publicly available and following PRISMA), but many of these guidelines and frameworks were

1 developed for other domains (e.g., medicine) and require adaptation or further development to better
2 suit applied sport contexts. For systematic reviews of applied sport psychology interventions, we
3 contend that key considerations for the development of the research question include (a) the
4 identification of key stakeholders, as their needs do not necessarily align with those of the researchers
5 (see Lasserson et al., 2019), and (b) the use of relevant analytical/conceptual frameworks, such as
6 PICO(T) (see Table 1), which help to determine the scope of the review and, in turn, minimise
7 ambiguity, enhance transparency, and reduce bias (McDonagh et al., 2008). For Cabral et al., their
8 research question related to the effectiveness of implicit-learning interventions on performance under
9 psychological pressure. In doing this, the authors suggested that a main contribution of the paper
10 would be to offer insight and clarification on previously inconsistent findings in this area. Without
11 considering potential stakeholders (e.g., coaches, athletes, physical educators, students, etc.) and their
12 intended usage, however, it is not certain how and to whom Cabral et al. intended to offer clarity. We
13 put forward that consideration of practitioners and applied contexts would be critical in a review of
14 implicit learning, as researchers in this area have indicated that implicit motor learning paradigms—
15 such as dual-task, errorless, and subliminal learning—are ecologically challenged, difficult to apply in
16 real-world settings, and result in slower learning than traditional practices (Poolton et al., 2006).
17 Because practising psychologists, coaches, and physical educators are encouraged to engage directly
18 with the literature, Cabral et al. missed an opportunity to enhance this review’s impact by accounting
19 for applied concerns in the research question. Without clarification on stakeholders and their needs
20 (and corresponding consideration of concerns regarding ecological validity of implicit learning), we
21 posit that the review of Cabral et al. is arguably limited to purely academic questions (i.e., psychology
22 *through* sport rather than *for* sport; see Collins & Kamin, 2012).

23 ***** Table 1 near here *****

24 Alongside the research question, such concerns are compounded by the authors not clearly
25 establishing the review’s objectives. In other disciplines (e.g., medicine), frameworks such as
26 PICO(T) are often expected or even mandated to ensure that relevant factors are identified and then
27 comprehensively and transparently addressed (see Lasserson et al., 2019). Indeed, for reviews of

1 applied interventions, we assert that it is critical to at least set forth (a) the population to which the
2 intervention applies, (b) the precise nature of the intervention of interest, (c) the comparison group
3 against which the intervention will be evaluated, and (d) the outcomes in which the effectiveness will
4 be measured (see Thomas et al., 2019). These represent a starting point for identifying the key
5 concepts for examination in a systematic review (see Lefebvre et al., 2019), as factors such as well-
6 designed comparison groups are regarded as essential for evaluating the effects of any sport
7 psychology intervention (see Bobrownicki et al., 2021 for a discussion on selection of comparison
8 groups). Without appropriate consideration of PICO(T), systematic reviews of interventions may
9 ultimately lead to difficult-to-interpret results and suboptimal recommendations for practice.

10 For this review more specifically, these steps to identify the objectives would be even more
11 crucial for several reasons. First, highlighting the necessity of carefully considering the specific
12 population and interventions for a systematic review, several studies have questioned the relevance
13 and suitability of some implicit methods for real-world sport (see Poolton & Zachry, 2007). Further to
14 this, Poolton and Zachry (2007) also suggested that some methods of implicit learning, such as
15 analogy instruction, are “technically explicit in nature” (p. 68). Despite acknowledging that “there is
16 no consensus on what interventions promote implicit learning” (p. 3), Cabral et al. (2022) forgo any
17 critical review of these implicit methods, consideration of possible reasons for the potential lack of
18 consensus (e.g., issues with how or to whom the methods are applied), or clearly specifying what the
19 interventions under investigation even are. In fact, the authors depend on differences to the
20 comparison groups in accrued verbal knowledge to determine what interventions might constitute
21 implicit learning, rather than any properties of the implicit methods themselves. Perhaps equally
22 concerning is that there have been previous attempts to systematically review (e.g., Kal et al., 2018)
23 and establish consensus regarding definitions of implicit and explicit learning (e.g., Kleynen et al.,
24 2014) that the authors did not explore, which would have been important for furthering discussion,
25 advancing the literature, and informing their objectives.

26 In addition to these concerns regarding population and intervention, we contend that the
27 development of PICO(T)-informed objectives would also have assisted Cabral et al. (2022) in

1 recognising and accounting for critical issues and debates in the implicit-learning literature relating to
2 comparison groups. Although unacknowledged in Cabral et al.'s systematic review, there exist several
3 significant methodological issues concerning comparison groups that have been (a) explicitly laid out
4 and debated in the implicit-learning literature (e.g., comparison groups are typically provided
5 instructions of much greater quantity, lesser quality, and different meaning; Bobrownicki et al., 2018),
6 (b) demonstrated empirically (Bobrownicki et al., 2015), and (c) proposed as likely explanations for
7 the previously inconsistent findings (Bobrownicki et al., 2019). Notably, even Masters and colleagues
8 have acknowledged that the long lists of instructions, which have customarily been provided to
9 comparison groups in the literature since the study of Masters (1992), do *not* reflect actual practice
10 (Tse et al., 2017). The unrepresentative comparisons that characterise the past three decades' worth of
11 research are thought to have limited ecological validity, influenced effect sizes, and impacted
12 resulting recommendations for practice (Bobrownicki et al., 2018). Between these longstanding, well-
13 known issues and the recognised significance of control conditions for evaluating applied
14 interventions (Bobrownicki et al., 2021), comparison groups *demand* careful consideration in the
15 systematic review of implicit learning of Cabral et al. (2022) that they never received. While we agree
16 with Cabral et al. that the inconsistencies in the implicit-learning literature required clarification, if
17 they wanted to achieve this, the authors needed to develop a research question and corresponding set
18 of objectives that appropriately considered: PICO(T); applied practice concerns; and the current
19 findings, issues, and debates in the literature. Such principles would be relevant not only for the
20 review of Cabral et al. (2022), however, but would also apply and be useful for systematic reviews of
21 applied interventions more broadly.

22 **Search Strategy and Inclusion Criteria**

23 Much like the research question and objectives, the search strategy employed by the authors is
24 also similarly impacted by their decisions to neither employ a framework such as PICO(T) nor
25 account for contemporary debates and known issues in the literature. Frameworks like PICO(T)
26 inform the structure and development of appropriate search strategies and search terms so that the
27 aims of the systematic review are suitably addressed (Lefebvre et al., 2019). As McDonagh et al.

1 (2008) put it, it is “essential” to specify exactly which individual interventions and comparators are of
2 interest, otherwise systematic reviews may over- or underestimate the benefits or detriments of the
3 intervention or even lead to uninterpretable results (pp. 9–10). It is also important to specify relevant
4 outcomes, including measurement methods and time points, for fear of biasing conclusions,
5 particularly in domains where there is considerable variability in measures such as psychology (see
6 McDonagh et al., 2008). Timing may be a particularly important factor to consider when reviewing
7 implicit motor learning because research has indicated that explicit and implicit learners perform
8 similarly in delayed retention tests (e.g., one-year after learning; Poolton et al., 2007), suggesting that
9 any benefits from implicit learning are hard earned (due to ecological and logistical challenges), but
10 short lived (possibly due to “decay of declarative knowledge”, Poolton et al., 2007, p. 456) and,
11 consequently, of potentially limited utility. These issues notwithstanding, there can be reasonable
12 arguments made that some elements of PICO(T) (e.g., comparator) should be excluded from the
13 search term in some instances (e.g., because studies in a particular area may not explicitly mention
14 comparison groups in the title or abstract; Lefebvre et al., 2019). If such exclusions are necessary,
15 however, we recommend that authors of systematic reviews of interventions indicate this in the text
16 and adjust their eligibility criteria accordingly so that the relevant factors are instead considered
17 during the assessment of the full-text articles in line with the PRISMA flow chart.

18 **Assessment of Bias and Quality**

19 The authors wisely followed a commonly used method for assessing bias in eligible studies
20 from a systematic search (i.e., Cochrane risk-of-bias tool, RoB 2). It is important to point out
21 however, that the selected risk-assessment tool was designed for medical interventions where the
22 comparison group is “usual care” (Higgins et al., 2019, p. 215), which does not align well with the
23 suboptimal, unrealistic comparison groups that often exemplify the implicit-learning literature
24 specifically (see Bobrownicki et al., 2018), let alone a comparison with best practice. For us, this
25 means that authors reviewing applied interventions in sport psychology need to adhere not only to
26 conventions regarding the assessment of bias, but should also consider the quality and relevance of
27 the eligible studies. Indeed, to produce a high-quality and informative review, it is critical to carefully

1 scrutinise the findings from eligible studies so that readers can, for instance, readily evaluate the
2 results, develop or refine associated theory, or integrate findings into practice (Tod et al., 2021).
3 According to Liabo et al. (2017), to assess the quality of eligible papers, it is important to consider (a)
4 the relevance of each paper's topic to the research question, (b) the appropriateness of the study type
5 to the research question, and (c) the soundness of the study methods. Given that there have been
6 several papers questioning the methodological practices in implicit-learning research, Cabral et al.
7 (2022) needed to carefully evaluate the methodological soundness of the included articles. As
8 concerns relating to comparison groups represent a broader issue for sport psychology and motor
9 learning research as well (see Bobrownicki et al., 2021), such advice would apply more generally too.

10 **Results and Discussion**

11 It is the results section where the issues raised in the preceding sections become most apparent.
12 As shown in Table 2, the number of instructions for the comparison groups in Cabral et al.'s included
13 studies outnumbered those for the implicit conditions by a substantial ratio of approximately 8:1.
14 Because systematic reviews should include critical appraisal, we contend that such unwarranted
15 discrepancies between conditions demanded and required attention from Cabral and colleagues. As
16 practising coaches, they also suggest to us that the observed differences in the literature may well
17 have arisen due to the volume of instruction rather than the type of learning. Further supporting this
18 point, where data are available, the instructions for the comparison groups included approximately 3–
19 14 times as many words compared to the implicit interventions. As the number of instructions for the
20 comparison groups likely exceeded working memory capacity and conflicted with real-world
21 recommendations for coaching practice (Mannie, 1998; McQuade, 2003), we argue that the authors
22 needed *at a minimum* to acknowledge these important limitations somewhere in their review. Indeed,
23 it is even conceded in one of the included studies of the systematic review that, because of the number
24 of instructions provided to the explicit learners, the verbal knowledge of these participants was
25 “artificially enlarged” (Masters, 1992, p. 349). From this, we do not think it is much of a leap to
26 suggest that participants with artificially enlarged pools of verbal knowledge may demonstrate
27 impaired performance or report more declarative knowledge. Unfortunately, Cabral et al. not only

1 based their key inclusion criterion on one of these arguably compromised measures (i.e., significant
2 differences in declarative knowledge between implicit and comparison groups), which is problematic
3 given the data displayed in Table 2, but they then also deliberately selected “the implicit learning
4 group showing the least amount of declarative knowledge accrual and the comparison group showing
5 the most” (p. 3), which raises further issues given the impact of control-group selection on effect sizes
6 as shown in Table 3.

7 **** Table 2 near here ****

8 For us, these decisions mean that Cabral et al.’s search methodology generated results that
9 arguably reinforce questionable, unjustified, and restrictive research practices. Moreover, with their
10 reliance on a key eligibility criterion that is steeped in those questioned practices, their review by
11 design would likely have excluded any studies that attempted to redress the unnecessary and
12 unrealistic differences in instruction volume (e.g., Bobrownicki et al., 2015, 2019; Meier et al., 2020;
13 Schlapkohl et al., 2012; Zeniya & Tanaka, 2021). Alongside this, it is important to acknowledge that
14 better designed comparison groups would be less likely to generate the larger pools of verbal
15 knowledge required to meet Cabral et al.’s inclusion criteria. Given the criticisms and debates in the
16 literature beginning with Bobrownicki et al. (2015), research published thereon should be expected to
17 control for instructional differences between the intervention and comparison groups to enhance
18 internal validity and better reflect real-world sport. Indeed, this may also explain why the majority of
19 studies from Cabral et al. are also relatively dated with 80% published more than a decade ago and
20 none more recently than 2013. We do agree with Cabral et al.’s recognition that the relatively small
21 sample sizes require attention, which has been an issue for studies old and new, although similar
22 concerns regarding sample size and underpowered studies have already been laid out in this very
23 research area (see Bobrownicki et al., 2018). In addition, future research will not be able to provide
24 any clearer insight or evidence through increased sample sizes or preregistered reports, as Cabral et al.
25 (2022) assert in their paper, unless the ongoing issues and limitations that pervade the implicit-
26 learning literature (e.g., inequitable and unrepresentative comparisons) are first appropriately
27 addressed. Reflecting on the weight of all these points, we contend that the results of this systematic

1 review reinforce the concerns presented earlier in this paper and highlight the importance of the
2 principles we have set forth (e.g., consideration of stakeholders; scrutiny of existing literature; use of
3 PICO to inform development of research question, objectives, and search term; assessment of quality)
4 to ensure meaningful results that can advance scholarship and practice.

5 **** Table 3 near here ****

6 **Future Directions**

7 The next step might be to pursue a collaboration between groups of authors for a systematic
8 review of implicit learning that addresses the concerns and principles discussed in the preceding
9 sections. In following the guidelines for adversarial collaboration (see Mellers et al., 2001), both sets
10 of authors could work together under mutually agreed protocols to conduct an ever-more rigorous
11 review. That said, we are concerned that even the most rigorously and carefully designed systematic
12 review might struggle to overcome the significant methodological and conceptual limitations in the
13 implicit-learning literature. Indeed, in defence of Cabral et al., the fundamental issue in this specific
14 instance may ultimately rest with the inherent limitations of the original research itself (e.g., concerns
15 regarding choice of tasks, ecological validity, comparison groups, sample sizes, and more). With this
16 in mind, there may be scope to collaborate to establish what constitutes an implicit-learning
17 intervention and how such interventions might be developed and validated.

18 At the same time, given the well-established critiques of implicit learning strategies, there may
19 even be cause to re-evaluate the concept, application, and merit of implicit learning within sport and
20 performance settings more generally. For instance, while implicit learning had traditionally been
21 treated as universally effective in the literature (see Bobrownicki et al., 2018 for discussion), there is
22 greater acceptance and use of explicit methods in practice and coaching frameworks (e.g., Five-A
23 Model; Carson & Collins, 2011). Moreover, recent studies suggest that conscious motor processing
24 may possess tenuous links to choking in competitive rowers (Sparks et al., 2021) and may even
25 enhance performance in novice golfers (Malhotra et al., 2015), which together challenge the
26 mechanistic foundations of implicit learning. Based on this, the best approach going forward may
27 instead relate to a methodological discussion or consensus paper for systematic reviews or meta-

1 analyses. Either way, whether it is an adversarial collaboration for a reformulated review, a more
2 applied examination and validation of implicit methods, or a methodological discussion between both
3 sets of authors, the concerns and principles discussed in this paper will also apply and be relevant to
4 systematic reviews of applied interventions more broadly.

5 **Concluding Thoughts**

6 In this review, we have raised procedural and methodological concerns regarding the
7 systematic review of Cabral et al. (2022). As Grant and Booth (2009) put it, the essence of the
8 systematic review is “gathering research, getting rid of rubbish, and summarising the best of what
9 remains” (p. 92). To deliver on this, it is our position that the authors needed to provide greater clarity
10 regarding their paper’s aims, better account for current debates and issues in the literature, and then
11 address these accordingly through their methodology (e.g., PICO, resulting search terms, etc.). As it
12 stands, the systematic review compared an undefined intervention against poor-quality and
13 unrepresentative comparison groups without acknowledging any of the key debates in this research
14 area. In doing this, rather than address the previously “inconsistent findings” (p. 3), we are concerned
15 that the authors have instead added to the inconsistencies and confusion in the literature. As
16 systematic reviews are widely utilised by sport and performance psychologists to guide and inform
17 their work, the quality of systematic reviews can have serious implications for practice, athlete
18 outcomes, and the discipline more generally (Tod et al., 2021). Going forward, we hope that the
19 points raised here highlight important principles to consider when planning a systematic review of
20 interventions in order to maximise contributions to the literature and applied practice.

21

22 **Data availability statement**

23 There is no data set associated with this manuscript.

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Table 1

Significance and implications of PICO(T) for systematic reviews of applied interventions in sport psychology. Inspired by similar table by McDonagh et al. (2008).

PICO(T) Criterion	Explanation	Significance for systematic reviews in sport psychology generally	Significance for the systematic review of Cabral et al. (2022)
Population	Sets forth relevant population of interest for intervention (e.g., learners, elite athletes, etc.)	The efficacy of interventions may vary depending upon the population to whom it is applied (e.g., novices or adolescents may be more receptive than adults or elite athletes). Moreover, there is considerable variability in participant characteristics in sport psychology (e.g., novices, adolescents, university students, older adults, elite athletes, etc.). As such, it is important for systematic reviews of interventions to clearly set out the population of interest so that results are informative and interpretable.	Without clarity on the population of interest, it is not certain whom this review is designed to impact, leaving potential for misleading (e.g., over- or under-estimation) or uninterpretable results. This is particularly important for Cabral et al.'s review because results suggest that implicit learning is not universally effective with, for instance, language or culture influencing its impact (e.g., an analogy that was successful with English speakers in Liao & Masters, 2001 proved ineffective for Chinese-speaking participants in Poolton et al., 2003).
Intervention	The specific intervention under investigation	Researchers should indicate what the intervention is and then operationally define the intervention using relevant evidence, precedent, or justification. Without undertaking this step, there may be interventions that are included in a review that, for instance, are not relevant (e.g., to the population) or differ in meaningful ways, which may compromise the results.	There have been questions raised in the literature regarding the utility and relevance of some implicit methods (e.g., dual-task, subliminal, or errorless learning). Indeed, in some cases, there are questions of whether the interventions should be considered implicit methods at all (e.g., Poolton and Zachry, 2007 stated that analogies were "technically explicit in nature"). As such, it would be important for Cabral et al.'s systematic review of implicit methods that clarity is provided by setting out what actually constitutes an implicit-learning intervention.
Comparator	The comparison group against which the intervention is being evaluated.	The comparison group is <i>essential</i> to understand the effects of any intervention (see Bobrownicki et al., 2021 for review) as their selection can impact effect sizes (see Goginsky & Collins, 1996 and Winter & Collins, 2013 for empirical demonstration). Without specifying at least one meaningful and relevant comparison for the intervention, the results have limited meaning and it is difficult to draw any conclusions to inform research or practice.	There are recognised long-term, pervasive issues in the implicit-learning literature of studies comparing implicit methods to poor-quality control groups (see Bobrownicki et al., 2018 for discussion). Despite these issues and the acknowledged importance of comparison groups, the systematic review of Cabral et al. (2022) does not account for these debates at any point in their review and do not specify against what implicit methods were to be compared. Given the variable quality of comparison groups in the literature, we contend that findings from this systematic review should be interpreted very cautiously.
Outcome	The outcomes that are being used to determine intervention effectiveness	Without a clarification and operationalisation of meaningful outcome measures and pressure manipulations, a review of effectiveness is difficult to deliver and place in context. For both empirical research and systematic reviews, it is important to consider what the results are actually saying about real-world performance and practice.	Implicit measures have been investigated using a number of different measures (e.g., outcome-based, kinematic, physiological, psychological, etc.) and pressure manipulations (e.g., money, observation, random letter generation, etc.). For an intervention, however, it is important for the authors to set out how the effectiveness of implicit learning will be judged and under what conditions. Even where dependent variables have been similar (e.g., Liao & Masters; 2001; Masters, 1992), such measures can still have much different meanings for the tasks involved (e.g., target accuracy to a pre-planned spot is less meaningful in table tennis than it is in golf), which makes interpretation of results more difficult.
Timeframe	The expected timetable for evaluating the intervention's effectiveness	For interventions, it is important to understand its effects over time. For instance, in evaluating a vaccine, researchers and doctors would want to know not only if it is effective and safe shortly after administering the intervention, but if the benefits persist over months and years. By extension, there is similar value in sport psychology in knowing if an intervention is useful for only a week or for many years.	Research suggests that the benefits of implicit learning do not persist over time (e.g., in a delayed-retention test, explicit and implicit learners perform similarly due to a possible "decay in verbal knowledge"; Poolton et al., 2007, p. 466). Given that persistence is considered a critical characteristic of learning (see Magill, 2014), timeframe should have constituted an important consideration for Cabral et al. (2022) if they were interested in evaluating the efficacy and utility of learning via implicit methods as purported.
Setting	The location of the data collection	This component is not always included with PICO(T), but it might be of greater importance for systematic reviews in sport psychology, as research and practice may take place in a wide variety of settings (e.g., laboratory, locker room, training facility, competition contexts, etc.), which might impact participants' behaviour and the representativeness of the task.	Although there is a place for laboratory studies, research must at some point begin to give way to the demands and questions of real-world sport (see Bobrownicki et al., 2015). To this point, research in implicit learning has focused on more academic questions (i.e., psychology <i>through</i> sport rather than <i>for</i> sport; Collins & Kamin, 2012) with more limited consideration of how such methods might be applied or might impact the field.

Table 2

Comparison of studies included in systematic review and meta-analysis of Cabral et al. (2022).

Study	Task	Conditions	Number of words in instructions	Number of rules for instructions	Number of reported verbal rules (<i>SD</i>)	Other notes
Schücker et al. (2013)	Golf putting	Analogy	6	1 †§	2 (1.01)	
		Explicit	86	6 §	3.38 (1.23)	
Vine et al. (2013)	Golf putting	Analogy	22	1	< 1 (<i>n/r</i>) *	
		Explicit	n/r	6	≈ 4.8 (<i>n/r</i>) *	
Zhu et al. (2011)	Golf putting	Errorless	n/a	n/a	0.72 (0.44)	
		Errorful	n/a	n/a	1.67 (1.12)	
Lam et al. (2009b)	Seated basketball shooting	Analogy	19	1	1.88 (1.28)	
		Explicit	78	8	6.17 (2.21)	
Koedijker et al. (2007)	Table tennis topspin forehand	Analogy	≈ 33	2 ‡	2.63 (1.30)	
		Explicit	88	14 ‡	6.78 (2.68)	
Liao and Masters (2001)	Table tennis topspin forehand	Analogy	≈ 29	2 ‡†	≈ 1.5 (<i>n/r</i>) *	
		Explicit	n/r	12 ‡†	≈ 7 (<i>n/r</i>) *	
Bright & Freedman (1998)	Golf putting	Dual-task	n/a	n/a	≈ 3 (<i>n/r</i>) *	Replication of Masters (1992)
		Explicit	n/r	13 ‡	≈ 4.8 (<i>n/r</i>) *	
Hardy et al. (1996)	Golf putting	Dual-task	n/a	n/a	2.75 (1.38)	Replication of Masters (1992)
		Explicit	n/r	13 #‡	5.63 (1.51)	
Masters (1992)	Golf putting	Dual-task	n/a	n/a	≈ 0.8 (<i>n/r</i>)	
		Explicit	n/r	13 #‡	≈ 6 (<i>n/r</i>)	

One study from the systematic review (i.e., Koedijker et al., 2008) is not listed as access could not be obtained.

n/a = does not apply n/r = not reported. † Participants also provided additional visual demonstrations or verbal instructions § Participants also received pictures demonstrating technique
 * Data were depicted graphically without providing exact figures ‡ Exact wordings of instructional groups not provided # Study does not report any details concerning instructions used;
 numbers obtained from Bright & Freedman, which purported to replicate Masters' (1992) methodology

Table 3

Demonstration of effect of comparison group selection in study design for implicit learning

Study	Task	Pressure manipulation	Measure	Comparison group	Number of rules	Number of words	Effect size compared to analogy condition (<i>d</i>)
Bobrownicki et al. (2015)	High jumping	Rising high-jump bar	Technique efficiency	Traditional explicit ($n = 7$)	8	96	1.44
				Explicit light ($n = 7$)	3	20	0.83
				Analogy ($n = 7$)	2	20	-