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Original Article

Connecting sport coaching, physical education, and motor learning to enhance pedagogical practices

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Abstract
Research in sport coaching, physical education, and motor learning has advanced tremendously in recent decades. Sports coaching has played an essential role in improving sports skills and competitive performance, whereas physical education has typically been an important aspect of promoting physically active lifestyles in school settings. A plethora of studies in the field of motor learning have been undertaken, with strong theoretical grounding in motor development, in order to augment critical pedagogical approaches that enhance student learning. Scholars are increasingly recognizing the significance of motor learning, as developing this skill is a crucial aspect of effective sport coaching and physical education.
Currently, however, very little conceptual knowledge circulates among the three disciplines. In other words, a disconnect often exists between the views of coaches and physical educators that has not been explored in the literature. It is necessary for researchers and practitioners in these areas to understand and expand pedagogical approaches on how learners acquire performance skills. Therefore, by addressing four common instructional strategies (CISs)—slow-motion demonstrations, feedback, sequential command style cues, and differentiated instruction, this paper explores how pedagogical practices can be reconsidered and adapted to better engage learners. Lastly, this article provides recommendations and applied examples of pedagogical approaches in motor learning and how they align with sport coaching and physical education. This article will help to bridge the gap among these fields and provide direction for practitioners and teacher educators. Future research in these areas, and the ways they might intersect, could help to build pedagogical practices that offer optimal environments for learners at all stages with various learning styles.
Key Words: Motor behavior, theoretical approach, school, children, adolescent, physical activity

Introduction

Over the last two decades, sports coaching has played a vital role in enhancing sports skills and competitive performance through training, whereas physical education has tended to be an important part of promoting physically active lifestyles in school contexts (Cassidy & Jones, & Potrac, 2015; Drewe, 2000). However, this viewpoint has been accompanied by the belief that coaching and teaching require different underpinning knowledge systems and practical skills (Jones, 2006). In light of such differences, scholars are starting to suggest educational practices that could help to further promote understanding about coaching since its relation to physical education can enlighten coaches and instructors (Quennerstedt, Öhman, & Armour, 2014).

As such, it seems the fields of coaching and teaching are "in need of closer connection" (Penney, 2006, p. 27). Thus, researchers are now acknowledging the importance of motor learning, as it is a skill development fundamental to physical education and coaching. While there is a growing body of literature on sport coaching and physical education through motor learning discipline (Orangi, Yaali, Bahram, van der Kamp, & Aghdasi, 2021; Poolton & Zachry, 2007), there are still relatively limited examples of effective performance or pedagogical practice. It is necessary, then, for researchers and practitioners in these areas to understand and advance knowledge on how students and athletes acquire performance skills effectively.

This paper explores how pedagogical practices can be reconsidered and modified to effectively engage learners based on four common instructional strategies (CISs)—slow-motion demonstrations, feedback, sequential command style cues, and differentiated instruction. Additionally, this article will reconsider the recommended practices for coaches and players, analyze observations about physical education programs, and then compare findings with scientific literature in physical education pedagogy and motor learning. Table 1 presents a summary of the four CISs, recommendations, and applied examples. Overall, the purpose of this examination is to help bridge the gap between coaching practices, physical education, and motor learning by offering evidence-based behavioral methods.

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Table 1. Overview of four CISs, recommendations, and examples

CISs	Recommendations for pedagogical practices	Applied examples
Slow-motion demonstrations	1. Use slow motion sparingly and always precede the slow-motion demonstration with demonstration of the skill at actual speed 2. Make comments on the key components of the movement and provide the information through different modalities (e.g., visual diagrams along with verbal instructions)	-Kicking in soccer: Using slow-motion, the instructors would focus on the step, swing, and kick (key components) while commenting, "Place your non-kicking foot next to the ball, swing back, and kick hard and focus on the follow through with your leg after you kick." By presenting the procedure of kicking in slow-motion, the student/athlete can concentrate on the body (e.g., knee drive) and the kinesthetic movement that it creates. Second, after the slow motion demonstration with key components, the instructor might integrate the kicking skill in real-time movement. Finally, instructors can let students/athletes practice the skills while detecting and correcting errors in game like contexts.
Feedback	1. Provide feedback often enough to facilitate learning and not provide feedback so often that the learner fails to become adequately involved in the problem-solving process. 2. Decrease the frequency of feedback over time since, as the skill develops, the level of precision may increase, and there should be a qualitative shift from prescriptive to descriptive feedback.	-Long jump: When learners are practicing the standing long jump as a novice learner, provide descriptive and specific skill feedback (e.g., "I see your form is improving—your stride is longer," or, "Tell me when you have a personal best for taking off"). As learners advance their skill level, instructors' may reduce the frequency of feedback.
Sequential command style cues	1. Use sparingly in skill development and only when the relative timing of the skill is not imperative to its proper execution and the process of performing the skill is the focus 2. Show a visual representation alongside the cue so that the learners can identify individual sequences clearly/effectively.	-Overhand throwing: Instructors demonstrate a throw in real-time and then highlight the individual steps of a throw with the cues and cue cards (e.g., pointing toward the target with the glove arm, follow through by letting your throwing arm come across the opposite side of your body). Afterwards, allow students to practice each step, and lastly, have students put the steps together to practice complete throws with partners.
Differentiated instruction	1. Provide various options for equipment/resource use so that learners can successfully engage in the learning experience. 2. Provide different levels of challenges by manipulating physical space and offering performance adjustments.	-Badminton: Instructors can offer a various range of racquet options for playing badminton so your students/athletes can show you their best performances. For instance, a learner may need a lighter or larger sized badminton racquet and a balloon to start out before progressing to regular sized ones. When explaining basic badminton skills, instructors would provide visual representations of the task (e.g., task cards, videos). In addition, instructors would offer two or three adjustments for game rules (e.g., allow students/athlete to serve the badminton from an overhand or an underhand serve from different distances; ways of scoring points) and provide options for task dimensions (e.g., number of players per team; size of playing area; height of net).

Pedagogical approaches

CIS # 1: Slow-motion demonstrations

Practices

While both slow-motion and real-time demonstrations are useful, Scully and Carnegie (1998) found that the observation of slow-motion demonstrations slightly facilitated the understanding and repetition of the model's coordination function better. In addition, the slow-motion demonstration should be accompanied by succinct verbal instructions, in order to improve understanding and performance of certain skills (Mawer, 1990; Ste-Marie, Lelievre, & St. Germain, 2020).

When teaching a skill to a novice athlete, coaches sometimes break down the skill and use slow-motion (either by demonstrating or performing the skill). For example, a college basketball assistant coach might break down skills in slow-motion when their players are not grasping the concept. In this context, the coach would have them practice it in slow-motion and gradually work up to full speed. This is helpful to students because being able to see the throwing motion in slow parts allows them to throw properly and guides them if they need to change their technique. Additionally, coaches might rely on slow-motion demonstrations if they lack the expertise to give a high-quality demonstration or if the skill they want to teach is performed too quickly at normal speed for the learner to comprehend what is happening (McMorris, 2014). Even though in certain circumstances demonstrating in slow-motion is considered to be an efficient technique to help learners acquire sport skills, it is always recommended to give a demonstration of the skill at actual speed before the slow-motion demonstration. Furthermore, slow-motion demonstrations are not recommended when speed is an essential component in the performance of the skill (McMorris, 2014). There is little physical education literature about whether or not a skill should be broken down into slow-motion to teach the process to a novice learner. However, according to Rink (2003), "if students do not practice in game-like conditions, they will not be able to play the game. If practice conditions are too game-like, beginning learners may not improve because the practice conditions are too difficult for them" (p. 169). In order to make an effective transition from slow-motion practice to game-like situations, physical educators need to consider students' skill levels to appropriately demonstrate a technique. Newell's (1986) model predicts two major outcomes in terms of slow-motion demonstration. First, it is expected that slow-motion will be as effective as real-time demonstrations in supporting the reproduction of an observed coordination pattern. Secondly, slow-motion is predicted to impair the approximation of control parameters of the demonstrated action. Apart from Newell's model, in relation to slow-motion skill demonstrations, research in motor learning is both limited and equivocal (Ste-Marie et al., 2012). Mediating factors such as skill complexity and movement characteristics are particularly important to the amount that slow-motion demonstrations aid learning and performance (Al-Abood et al., 2001). Further, while certain aspects of a skill may be learned through observation of the skill performed at slow-motion (e.g., relative timing-definition), others may be impaired (e.g., absolute timing-definition; Scully & Carnegie, 1998; Ste-Marie et al., 2020). To maximize the efficacy of the demonstration, one should only highlight properly executed models (Shea, Wright, Wulf, & Whitacre, 2000) with correct relative timing (Blandin, Lhuisset, & Proteau, 1999) in full speed and from appropriate angles (Schmidt & Wrisberg, 2008).

In terms of slow-motion practice, two motor learning constructs must be considered to determine the efficacy of slow-motion learning: specificity of practice and skill transfer (Ste-Marie et al., 2012). The concept of specificity of practice means that what individuals learn depends largely on what they practice. This is the "notion that the best learning experiences are those that approximate most closely the movement components and environmental conditions of the skill and the context" (Schmidt, Lee, Winstein, Wulf, & Zelaznik, 2018); this is essentially the same notion described by Rink (2003) in the previous section. The question then becomes: Is the slower version of the skill truly mimicking the full speed version of the skill while in practice? According to Hall and Magill (1995), "the more similar practice and test conditions are the more likely skill learning will transfer from practice to game." A potential issue with slow-motion learning is the degree to which the skill practiced in slow-motion mirrors the desired skill at full speed. Individuals must learn the underlying timing relationships or relative timing of limb actions – how each body part moves in relation to others to produce ideal results (Schmidt et al., 2018). They must also learn the sensory consequences of the specific movement. These create a learned representation of the skill, linking segmented actions to each other, and allows for error detection and correction. Additionally, skill transfer is a principle that suggests slow-motion might be problematic (Schmidt & Lee, 2019). Motor learning research is unequivocal about skill transfer – it is not effective unless the skills are highly similar (McMorris, 1998). The activities should have common movement patterning and both perceptual and conceptual skill elements. Thus, the amount of transfer depends on the similarity of the practiced skill to the target skill (Brady, 1998). If slow-motion demonstrations/practices provide nearly identical relative timing relationships to the full speed action, then some skill transfer may occur. However, coaches run the risk of changing timing relationships by emphasizing different aspects of the skill. If the slow version of the skill is different than the full speed version, then the individual may experience little, none, or even negative transfer to a game-like situation. Thus, the sensory consequences of moving slowly will differ from real time movements, inhibiting the process to detect and correct errors in game-like contexts.

Recommendations

When it comes to sport coaching and physical education, it is far too easy for students to miss key parts of a demonstration if the skill is shown in real-time (Graham, 2008). Therefore, this is one instance where slowing the speed of the skill is beneficial as it allows the instructor to make comments on the key components of the movement (Graham, 2008). However, because of the potential danger in misrepresenting skills, it is not recommended for coaches and physical educators if it can be avoided. In the end, slow-motion demonstration should be used sparingly, and the demonstration of the skill at actual speed should always precede the slow-motion demonstration.

CIS #2: Feedback

Practices

Feedback is inextricably tied to processes of learning and teaching (Peterson & Irving, 2008) and many researches have focused on its uses and effectiveness. According to the researched literature, feedback is generally thought of as information students and athletes receive to help improve performance (Lee, Keh, & Magill, 1993; Mouratidis, Vansteenkiste, Lens, & Sideridis, 2008; Zhou, Shao, & Wang, 2021). Students and athletes receive feedback in a variety of ways, such as what they feel or experience when executing a movement (knowledge of how to the perform the action), the outcome of the movement (e.g., a shot going into the basket, the curve of a pitched ball), and the external instructional feedback they receive from instructors to help refine a skill (Van Mullem, Shimon, & Van Mullem, 2017). Feedback includes both the type of feedback a coach or physical educator provides to the individual as well as the frequency of this feedback. Specifically, general-type feedback is often used to help motivate student-athletes, while augmented feedback is information about motor skill performance that supplements the learner's own sensory feedback (Schmidt et al., 2018).

Traditionally, coaches have tended to provide copious amounts of verbal feedback in the belief that "more is better" for the effective acquisition of motor skills (Williams & Hodges, 2005). Coaches use general feedback (i.e., "Great job," or "Way to go,"). Often, athletes do not understand what the terms used in general feedback mean, so coaches may wish to clarify their statements. For example, instead of "good job," coaches might say, "good job pointing to the target," or instead of "way to go" coaches might say "way to go with the follow through." Either way, while athletes require feedback to refine and develop their skills, it is important to realize that this information can be required through many different routes and methods, not all of which are equally effective (Davids, Bennett, & Button, 2008). Additionally, teaching environments contain many variables that make it necessary for feedback to be tailored to specific circumstances, and learning a new skill demands a large amount of athletes' cognitive attention (Holding, 1965; Housner & Griffey, 1994; Wulf, Chiviacowsky, Schiller, & Avila, 2010. As a coach, it is important to deliver the most effective and simple corrective feedback to students in order to reduce the amount of distracting or extraneous cognitive processes. Hence, important questions to consider are how often augmented feedback should be provided, how precise it should be, and when it should be provided (Otte, Davids, Millar, & Klatt, 2020).

The interactions that physical education teachers have with students are critical to learning different sports skills (Rink, 2020). In particular, feedback is used as an instructional strategy in teaching physical education that guides student attention to a specific movement or skill (Davids et al., 2008; Wulf et al., 2010). Frequently, the most effective physical education teachers have been known to deliver frequent feedback while also possessing the ability to detect individual student needs and errors (Lee et al., 1993; Wulf et al., 2010). As a result, it is common practice for physical education teacher education programs to instill the importance of delivering quality, timely, and individualized verbal feedback to students in order to effectively teach a skill (Housner & Griffey, 1994; Lee et al., 1993). Since the type and frequency of feedback needed is contextual (Wulf, 2013), it is important to distinguish how teacher feedback can best be implemented while teaching students novel skills. Fredenburg, Lee, and Solmon (2001) report how augmented feedback influences practice behaviors and what influence augmented feedback has on performance scores during the motor skill instruction of the novel task of sport-stacking. Specifically, the four augmented feedback conditions were: (a) no feedback, (b) positive feedback, (c) task knowledge feedback, and (d) positive, motivational feedback and task knowledge feedback. The results were that feedback treatments significantly influenced performance scores in motor complex skills but not simple skills. Also, the analysis for the more complex skills indicated that all four feedback conditions produced improved performance, but the rate at which performance improved varied according to the type of feedback provided. Task feedback and motivational and task feedback resulted in a more rapid increase than either no feedback or only motivational feedback. Such research findings suggest that information regarding how to perform a task is crucial and necessary in the initial stages when learning complex or challenging skills (Di Tore, Schiavo, & D'Isanto, 2016).

A plethora of studies in the field of motor learning have been conducted over the past years, providing rich insights on the vital role of feedback on learning, performance, and behavioral change (e.g., Bilodeau & Bilodeau, 1961; Sullivan, Kantak, & Burtner, 2008). These studies have shown that feedback concerning motor learning can be largely classified into two subcategories. The first type of performance-related feedback is task intrinsic feedback, which instructors present as the sensory-perceptual information that is perceived by exteroceptors and interceptors while executing a movement (Lauber & Keller, 2014). The second type of performance-related feedback is called augmented feedback. The term augmented was chosen as this type of feedback adds additional information from an external source to the intrinsic feedback (Lauber & Keller, 2014). Augmented feedback is provided in two ways: (1) error information found in the performance and the method to correct those identified errors, and (2) a method which raises the performance level for difficult motor skills and enhances the speed of learning process for students to achieve the performance goal (Chow, Davids, Button, & Renshaw, 2016). Depending on the situation, augmented feedback can be directed to two different ends: knowledge of result, which is the extrinsic verbalizable information about the outcome of an action, and knowledge of performance, which is the extrinsic verbalizable information about the action itself (Lee, Swinnen, & Serrien, 1994).

Recommendations

The frequent delivery of corrective feedback to each individual student upon each incorrect movement pattern for each practice trial is impossible. Further, the instructor does not need to serve as the sole method of feedback delivery. However, by thoughtfully and creatively constructing feedback statements, the teacher or coach can engage with students in the responsibilities of identifying errors and analyzing their skills (Housner & Griffey, 1994). A student can be taught to recognize alternative methods of corrective feedback, such as achieving the task outcome or knowledge of results (i.e., hitting a target), utilizing kinesthetic or tactile prompts (i.e., tapping the back during a follow through), relating a movement to a familiar construct, metaphor, or analogy (i.e., moving your arm like a rainbow), or relating the movement to a previously learned skill (i.e., the follow through is similar to that of throwing a lacrosse ball). These examples of externally-focused feedback provide the learner with a simpler and more tangible way to self-analyze their skills that is independent of instructor verbal feedback, minimize time spent in the cognitive stage of learning by progressing to a more autonomous and independent stage of learning, and reduce cognitive anxieties related to movement (Otte et al., 2020; Wulf et al., 2010).

Williams and Hodges (2005) assert that the optimal frequency of augmented feedback appears to be dependent on the students' stage of learning and the complexity of the task. In the initial stages of learning or when the task to be learned is fairly difficult, playes may require precise feedback more frequently to improve performance (Magill & Wood, 1986; Wulf, Shea, & Matschiner, 1998). That is, the frequency of feedback should decrease as the skill develops, the level of precision should increase, and there should be a qualitative shift from prescriptive to descriptive feedback (Williams & Hodges, 2005). Hence, it is crucial for the instructors to achieve the correct balance between providing sufficient feedback to facilitate learning and giving excessive feedback where the learner fails to efficiently participate in the problem-solving process. Since the performer is likely to develop skills that transfer effectively to similar contexts, instructors need to determine when and how augmented information should be offered to effectively promote motor learning (Hall & Magill, 1995; Otte et al., 2020).

CIS #3: Sequential command style cues

Practices

The command style approach places coaches and physical education teachers at the forefront of leading students/athletes in drill work and conditioning activities (Van Mullem et al., 2017). This style is often used when the focus is on skill development and repetition (Bennett & Culpan, 2014). Moreover, teaching or coaching cues are short, catchy words or phrases that help define a specific movement or action in a meaningful way (Rink, 2020). In this article, sequential command style cues are command cues that occur in a specific order.

Coaches are aware of the need to conform to certain principles for safety, movement proficiency, and/or performance accuracy, and they often do so by using command style cues. Coaches may decide to use the command style approach if team sizes are large, if practice time is limited (Mosston & Ashworth, 2008). Specifically, coaches will use sequential command style cues to teach motor skills to their team so that the entire team executes the skill in the same manner to increase their performance. For example, a track and field coach might have all his throwers time throwing patterns to his cues: "Balance, turn, and release." Hence, by using this approach, coaches can facilitate experiences for group coordination and success (Mosston & Ashworth, 2002).

The most common application in physical education of sequential command style cues often occurs during a warm-up, such as static stretching or aerobics, or during the beginning phases of skill learning. For instance, during a basketball unit at an elementary school, a teacher could instruct a progression that was designed to improve basketball-handling skills. The teacher will tell students when to change hands, how high to dribble, when to dribble through their legs, and when to stop. Moreover, physical education teachers believe that command style has advantages related to maintaining discipline, organization, and achieving precise performances (Metzler, 2011; Rink, 2020).

The use of sequential command style cues to teach a skill has more cons than pros with motor learning. As described previously, in early stages of motor learning, individuals must "get the idea of the movement" (Gentile, 1972); in other words, they must learn the underlying relative timing relationship throughout their bodies that leads to successful performance of a skill. If command style cues are used to produce the skill, individuals might not learn these relationships and only learn to move in a prescribed pattern as a response to an external cue. External cues can slow motor skill learning because the learner relies on the coaches' cue to perform the skill and therefore cannot produce it independently of that cue. Motor learning research offers a solution to the use of external cues (Goodman & Wood, 2009). In order to combat performers becoming reliant on instructors while allowing instructors to provide feedback for skill promotion, faded feedback can be used in conjunction with command style cues. Faded feedback is defined as "a schedule for providing extrinsic feedback in which relative frequency of feedback presentation is high during early practice and diminishes during later practice" (Schmidt et al., 2018). As the performer is learning the skill, high amounts of feedback are given; eventually, feedback is tapered off and used only to reinforce proper mechanics (Wu et al., 2011). Research has demonstrated that a faded feedback technique works for a variety of skills and populations, although it is not as effective in children as adults (Hemayattalab & Rostami, 2010; Winstein & Schmidt, 1990; Weeks & Kordus, 1998). Performers should be asked how the skill feels and/or what they felt when the execution went right or wrong. Both faded feedback and questions that lead to developing individual skill levels are helpful for eliminating dependence on coaches and improving error detection by performers. The use of command style sequenced cues can only inhibit both skill development and self-correction.

Recommendations

Though sometimes used to improve performance, according to the motor learning literature, sequential command style cues are only appropriate when the relative timing of the skill is not imperative to its proper execution and the process of performing the skill is the focus. There are instances when sequential command style cues are appropriate such as static stretching and aerobics. However, sequential command style cues should be used sparingly in skill development and with faded feedback to lessen the dependence on coaches and increase the learners' kinesthetic awareness.

CIS #4: Differentiated instruction

Practices

Differentiated instruction involves developing teaching materials with various options in order for all students and athletes to learn effectively (Siedentop & Tannehill, 2000). Willis and Mann (2000) defined the teaching philosophy of differentiated instruction based on the concept "one size does not fit all." As such, coaches and educators must recognize that learners differ in various factors—such as culture, learning style, background, and gender—and address those differences with an awareness of the unique readiness, interest, and learning profile of each. Specifically, Tomlinson (2000) states that teachers can manipulate at least four classroom elements: content, process, products, and learning environment. Thus, instructors are expected to make explicit decisions about the nature of the learning content, processes, and products so that each learner, from pre-kindergarten to college, may learn equally (Algozzinea & Anderson, 2007).

Differentiated instruction rarely occurs in the context of advanced team sports, perhaps due to a belief that athletes should have a solid performance-base in order to participate on the team. In other words, coaches assume that their players should be at a certain level, and thus, they do not usually accommodate alternatives. Some competitive sports teams use differentiated instruction in weight training, conditioning and with individual workouts but rarely in full team practices. For athletes, who may vary on preferred coaching style based on their gender, level of competition, type of sport, type of task, team status, and performance (Solomon, 1999), differentiated instruction might be more desirable for some while less desirable for others. According to Gearity (2012), athletes consider a failure to use differentiated instruction in accordance with the unique needs of each athlete as a lack of coaching competence to drive sport performance. Differentiated instruction, then, might be beneficial for some team sport athletes.

Differentiated instruction is implemented in physical education classes to promote inclusion, diversity and general physical education strategies (Ellis, Lieberman, & LeRoux, 2009). Minerek and Lintner (2011) describe that "instead of asking the student to be flexible in how they learn, differentiated instruction asks physical education teachers to be flexible in how they design instruction" (p. 54). Physical education classes are one of the most diverse settings in schools today (i.e., different skill levels, physical disabilities, various backgrounds; Morrison & Gleddie, 2021). If implemented properly, differentiated instruction is necessary to effectively engage all students in a gymnasium. For example, one elementary school implemented differentiated instruction during a gymnastics unit that included activities such as vault, balance beam, parallel bars, rope climbing, and tumbling. Each apparatus was a part of a circuit, where each student had to try every apparatus, moving across stations throughout the process. Each station had various skill levels that increased in difficulty. While students had to successfully complete a given skill level in order to move onto the more difficult one, it was the students' choice whether or not to do so. New skills levels could be tried, but only after spotting with a teacher. Finally, the students designed a routine for assessment based on two of their mastered stations. The class composition consisted of several high performers who competed at competitive gymnastics clubs, a few lower performers with no previous experience, a student with a physical disability, and the rest of the students had previous experience stemming from physical education only. The differentiated instruction used in this gymnastics design accommodated all of the aforementioned students.

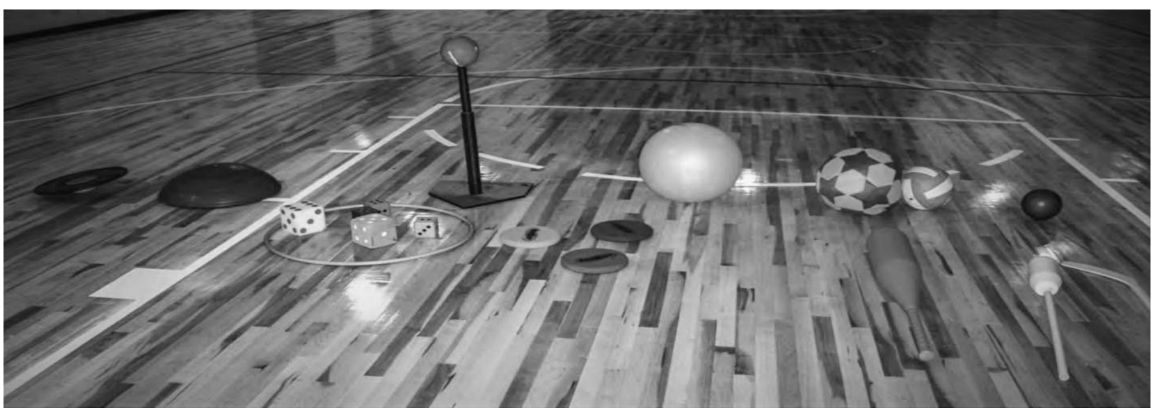
The notion that all individuals have different levels of ability, cognition, and skill is fundamental to motor learning (Anderson, Lohse, Lopes, & Williams, 2021). Even at the advanced level, individual players have different underlying abilities such as reaction time and eye-hand coordination, which influence performance (Anderson et al., 2021). Furthermore, each athlete has had a myriad of experiences over time leading up to high level competition (Gearity, 2012). High-level performance requires that individuals reach the most advanced learning stage, that of autonomy. An athlete reaches this stage when he or she performs specific motor skills without conscious thought, freeing attentional resources for other activities necessary for high-level performance. In order to have the majority of athletes on a team or in a class achieve the autonomous stage of performance, practitioners must understand the unique underlying abilities of each athlete as well as previous experiences in addition to individual learning styles (Fuelscher, Ball, & MacMahon, 2012). An example of differentiated instruction is a softball coach who structures a hitting circuit to promote both intrinsic and augmented feedback. Some individuals are more receptive to intrinsic feedback (how an impact of a ball on the bat feels, how much their muscles are tensing) and others are more apt to benefit from augmented feedback/external feedback. The intrinsic feedback station would come in the form of hitting a softball off a batting tee into a close-range net. The hitter has a partner who places the ball on the tee. The partner's job is to ask questions such as, “How does that feel? Did your hands vibrate? Do you think you felt the sweet spot of the ball when you contracted it?” These questions promote conscious thought of how the muscles feel during the process with little knowledge of results. The idea is to improve the hitter’s “feel” of the swing. Augmented feedback can appear in various forms that create success for audio, visual, and kinesthetic learners. The audio station contains positive specific feedback given by a coach or a peer to the hitter after swinging. The hitter can see knowledge of results because the station is designed to allow the softball to travel over enough distance to gauge flight path. Knowledge of performance is reinforced through verbal feedback. Additionally, the performer’s swing is videotaped, and they can see both knowledge of the results and knowledge of the performance. Kinesthetic learners gain results through manual manipulation. If a coach or a teacher sees an incorrect execution of a skill, the instructor will manipulate the performer’s body in the proper position and ask them to execute the skill again. The performer will then repeat the skill on his/her own. When learners have choices to pick the station that is most conducive to their learning style, they will achieve higher success rates than if they are forced to complete practice in a manner that is not aligned with their style of learning.

Recommendations

Differentiated instruction used in physical education and youth sports is considered effective (Colquitt, Pritchard, Johnson, & McCollum, 2017). Shimon (2020) advocated differentiation a*s* diversity that encompasses all aspects of planning, teaching and the organization of the learning environment. This approach also shows different avenues to acquiring skills, to processing or comprehending ideas, and to developing practices so that each student makes progress in relation to achieving objectives effectively (e.g., skill mastery, cognitive knowledge).

Thus, coaches and physical education teachers should provide various options for equipment use so that students can successfully engage in the learning experience (Figure 1). For instance, when teaching jump roping, instructors should offer variations in the types of ropes, the length of ropes, and the way the students can choose to jump. Also, instructors should offer different levels of challenges by manipulating physical space (e.g., size of area) and offering performance adjustments (e.g., allowing students/athletes to make choices). For example, during a dance unit, students can choose the beat of the music (two-, four-, or eight count beat), can work in small groups or alone, and can determine if it is hip-hop, tango, or ballroom. These pedagogical strategies can modify students' speed and motor ability comprehension, thus leading to increased development. In sum, inclusive teaching requires thoughtful consideration of the planned and enacted curriculum to ensure meaningful participation and progress for all students.

Figure 1. A variety of equipment for learners



Conclusion

There is a greater need to develop pedagogical practices that provide students with the relevant learning to be effectively involved in physically active lifestyles that reap critical health benefits. Thus, in this paper, four CISs in sport coaching and physical education practices were presented through the perspectives of coaches and athletes as well as observations of physical education settings.

Moreover, the paper offered reconsiderations of physical education and motor learning literature. As there is a disconnect between sport coaching, physical education, and motor learning, the purpose for the presentation of the four above-mentioned CISs were to bridge that gap among these areas and provide recommendations for practitioners and teacher educators. As they are not mutually exclusive, each discipline can gain insights and benefits from studying each other. Ultimately, this intersection of sport coaching, physical education, and motor learning can improve students' performance by developing efficient pedagogical practices. Future research in these areas, and the ways they might intersect, could help to change pedagogical practices positively to offer optimal environments for learners at all stages with various learning styles.

Discolsure Statement

The author did not report any potential conflict of interest.

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