

BEHAVIORAL COACHING TO IMPROVE OFFENSIVE LINE PASS-BLOCKING SKILLS OF HIGH SCHOOL FOOTBALL ATHLETES

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We evaluated several behavioral coaching procedures for improving offensive line pass-blocking skills with 5 high school varsity football players. Pass blocking was measured during practice drills and games, and our intervention included descriptive feedback with and without video feedback and teaching with acoustical guidance (TAG). Intervention components and pass blocking were evaluated in a multiple baseline design, which showed that video feedback and TAG were the most effective procedures. For all players, improved pass blocking matched a standard derived by observing more experienced linemen and was evident in games. Additional intervention was required to maintain pass-blocking proficiency. Issues pertinent to behavioral coaching and sport psychology research are discussed.

Key words: behavioral coaching, football, performance feedback, teaching with acoustical guidance

Consistent with the cornerstones of applied behavior analysis, behavioral coaching involves selecting measurable behaviors, implementing operant-based procedures, and evaluating behavior change as a function of intervention (Martin & Hrycaiko, 1983). Furthermore, cognitive and motor control researchers have identified behavioral coaching as a critical element in developing expert and elite-level performance in sports (Starkes & Ericsson, 2003). Behavioral coaching programs typically combine several procedures, such as verbal instruction, prompting, goal setting, performance feedback, and positive reinforcement. Research has shown behavioral coaching to be

effective with sports such as swimming (Hazen, Johnstone, Martin, & Srikameswaran, 1990; Koop & Martin, 1983), track (Shapiro & Shapiro, 1985), figure skating (Hume, Martin, Gonzalez, Cracklen, & Genthon, 1985), tennis (Buzas & Ayllon, 1981), and gymnastics (Wolko, Hrycaiko, & Martin, 1983).

Relative to football, which was the focus of the present study, Ward and Carnes (2002) found that having five linebackers on a National Association of Intercollegiate Athletics (NAIA) Division II football team set performance goals and receive publicly posted feedback improved their correct execution of reads, drops, and tackles during practice sessions and games. In another study, Smith and Ward (2006) reported that a combination of public posting with verbal feedback and goal setting improved blocking, route running, and releases of three wide receivers who also played on an NAIA Division II football team. Although the interventions evaluated by Ward and Carnes and

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Smith and Ward included several components, providing behavior-contingent feedback to enhance performance was common to both.

Allison and Ayllon (1980) also used behavioral coaching with five younger boys (ages 11 and 12 years) on a citywide football team. The dependent measure was the percentage of correct blocks executed correctly during practice drills. Under baseline conditions, the football coach implemented typical procedures (praise, encouragement, correction), but blocking did not improve. The behavioral intervention involved the coach yelling "freeze" when a player blocked incorrectly, demonstrating how the block should have been executed, and instructing the player to imitate what he had been shown. These procedures were effective in improving blocking with all of the boys. Similar to the research by Ward and Carnes (2002) and Smith and Ward (2006), the Allison and Ayllon study relied on performance feedback as a primary component of intervention.

Because it is not likely that all procedures will improve athletic performance of all athletes, different intervention methods should be incorporated in behavioral coaching research (Martin, Vause, & Schwartzman, 2005). Moreover, few studies have assessed athletes' preferences for the various behavioral interventions that are available to coaches (Smith & Ward, 2006). As noted by Kazdin (1977) and Wolf (1978), consumer preference for different interventions is a useful social validity outcome measure. Finally, despite nearly three decades of behavior-analytic applications in sport psychology, research has measured performance during actual competitive athletic events infrequently (Martin *et al.*).

The purpose of the present study was to evaluate the effects of several behavioral coaching intervention procedures on offensive line pass-blocking skills of high school football athletes. The procedures included different methods for providing performance feedback and were implemented by the offensive line

coach during practice pass-blocking drills. The performance of several of the athletes was also measured during game conditions and a maintenance phase when they returned for a second season. Additional evaluation included a social validity assessment in which the athletes rated the relative value of each of the intervention procedures.

METHOD

Participants and Setting

The participants were five students who attended a public high school. They were selected for the study because the coaching staff had identified them as having the poorest pass-blocking skills from a pool of 15 offensive linemen on the varsity football team. Linemen who had started at least one game during the previous season were excluded from the study, as were two other linemen who had played extensively at the varsity level. Our rationale for this selection process was to evaluate procedures with the least competent and experienced players.

None of the participants had more than 5 years of football playing experience. Matt was a senior, Dan and Logan were juniors, and Steve and Russ were sophomores. The mean age of the participants was 16.2 years (range, 15 to 17 years), with a mean height of 183 cm (range, 174 to 201 cm) and mean body weight of 89 kg (range, 79 to 100 kg). Other than being told that they would be receiving coaching in pass blocking, the participants were not informed about the purpose of the study. The parents of each participant provided written informed consent.

The offensive line coach implemented the measurement and intervention procedures (described below). He was a bachelors-level teacher with 2 years coaching experience at the high school level. His involvement in the study was voluntary.

Measurement

Blocking was defined according to the 10-step task analysis shown in Table 1. Five college

Table 1
Ten-Step Blocking Task Analysis

Step	Description
1	Stance Feet shoulder-width apart, 50% bend at the knees, buttocks down over heels, center-side hand touching the ground
2	Split Sideline foot back slightly with toe to heel of center-side foot
3	First step Make play-side bucket step while maintaining balance
4	Helmet contact Helmet facemask makes contact with opponent at the top of jersey number
5	Hand placement Pointer fingers at 11:00 o'clock and 1:00 o'clock with thumbs pointed towards opponent's Adam's apple
6	Hand position Hands maintained inside opponent's shoulder pads and torso frame
7	Arm extension Arms extended outward beyond 45 degrees
8	Hip follow through Hips rolled towards opponent's belly button
9	Leg drive Maintain continuous running leg pump until whistle sounds
10	Hand contact Hands in contact with opponent's body until whistle sounds

offensive line coaches (acquaintances of the senior author) were surveyed before the study to validate the steps selected in the task analysis. Each step was listed in sequence on a recording form. The dependent measure was the percentage of steps executed correctly during a practice pass-blocking drill and league football games.

Measurement during the pass-blocking drill was conducted at weekly practice sessions. The drill began with a participant assuming a three-point stance (one hand and two feet in contact with the ground) at the 5-yard field stripe. An orange traffic cone was placed approximately 5 yards behind the participant, with one member of the coaching staff standing behind the cone. A defensive lineman in a four-point stance (two hands and two feet in contact with the ground) was positioned approximately 1 yard in front of the participant. In response to the correct offensive cadence, a participant had to block the rushing defensive lineman within a 3-yard lateral boundary, preventing him from touching the orange cone. The pass-blocking drill continued until either 10 s elapsed or the defensive lineman touched the orange cone, whichever came first.

The offensive line coach observed each participant during a single pass-blocking drill, recording a plus or a minus on the task analysis form next to each step that the participant executed correctly and incorrectly, respectively. Before the study, the senior author trained the

coach to record data by watching videotaped pass-blocking drills from the previous season's practices. Training continued until the senior author and the coach achieved 90% or greater interobserver agreement for three consecutive drills. Additional training consisted of the senior author and coach observing offensive linemen perform pass-blocking drills during actual practice sessions. This training was completed when we achieved 90% or greater agreement for three consecutive drills.

Observers measured pass blocking during games from videotapes using the previously described task analysis form. A single game was videotaped for Dan and Matt during the first season and for Dan, Steve, and Russ during the second season. The offensive line coach recorded the initial three (Dan, Matt, and Russ) or four (Steve) pass-blocking sequences from the videotapes for each of these participants.

Interobserver Agreement

During the study, 50% of the practice pass-blocking drills were videotaped for all participants. We assessed interobserver agreement by having the senior author record pass-blocking execution on the 10-step task analysis form. These results were compared with the real-time data that had been scored by the offensive line coach. An agreement was tallied if both observers rated each step identically (correct execution or incorrect execution). Interobserver

agreement was computed by dividing the number of agreements by the number of agreements plus disagreements and converting the ratio to a percentage. Mean agreement was 90% (range, 50% to 100%). We also assessed interobserver agreement during 50% of the videotaped games using the same method of calculation described for the pass-blocking drill. Mean game agreement assessments were 88% (range, 70% to 100%). Note that the two low percentages of 50% and 70% were the only scores below 85% and were associated with one participant (Russ).

Normative Assessment

Before the study, the senior author and the offensive line coach recorded pass blocking of the three highest rated starting offensive linemen from the previous season. We recorded data on the 10-step task analysis form for the initial pass-blocking opportunity by each lineman during three videotaped games with high school opponents (interobserver agreement was assessed during 100% of the pass-blocking sequences, and mean agreement was 87%, with a range of 70% to 100%). Mean correct pass-blocking accuracy for the three linemen was 80% (range, 70% to 90%). Therefore, we adopted a range of 70% to 90% as our acceptable performance criterion.

Intervention and Research Design

Intervention components were evaluated in a multiple baseline design across participants. Baseline, descriptive feedback, and descriptive feedback plus video feedback phases were implemented with all of the participants. Four of the participants also received teaching with acoustical guidance (TAG). Procedures during baseline and intervention phases were implemented at a Wednesday practice session each week because that was the day typically scheduled for individual offensive skills drills.

Baseline. Baseline procedures were those in effect before the study. Specifically, the offensive line coach instructed the participants

during the pass-blocking drill, emphasizing proper execution by reminding them about positional technique and staying focused. He usually praised the participants when they blocked correctly, for example, making a statement such as "good work" or "That's the way to hit!" Occasionally, he delivered a slap on the back of the helmet to acknowledge good performance. In response to poor execution, the coach typically responded negatively with a remark such as, "That stinks, you didn't take a drop step," sometimes followed by modeling the desired pass-blocking behaviors. During the baseline phase, no other programmed consequences were delivered.

Descriptive feedback. Baseline conditions remained in effect except that the coach showed the completed 10-step task analysis form to each participant following the pass-blocking drill. He reviewed steps that participants executed correctly and incorrectly through a combination of instruction, modeling, and physical prompting. Correct steps received praise (e.g., "Great, keep it up!") and nonverbal approval (e.g., slapping a high five). The coach responded to incorrect steps by explaining how they should have been executed, having a participant perform the steps one time correctly, and giving verbal feedback for those steps (e.g., "That's it, now you've got it!"). Participants were allowed to question the coach about how to further refine their performances.

Descriptive feedback plus video feedback. In addition to descriptive feedback, each participant watched a videotape of the practice drill he had just completed. The videotape was shown to each participant immediately following the drill. Together, the coach and participant rated performance on the task analysis form during their videotape observation. Praise and correction from the coach, as described above, were contingent on correctly executed and incorrectly executed steps, respectively. The video feedback concluded by having each participant perform the pass-blocking sequence by himself, one

time, without a rushing defensive lineman and without the coach's praise or correction.

Teaching with acoustical guidance. Four of the five participants received the TAG condition following the descriptive plus video feedback phase. One participant was excluded because he started playing regularly in league games after the descriptive plus video feedback phase due to an injury sustained by one of the team's starting offensive linemen. With TAG, an audible stimulus such as a click or chirp is sounded to signify that a desired behavior has occurred (Pryor, 1999). TAG is similar to concurrent auditory feedback, an intervention used in motor-skills learning (Konttinen, Mononen, Viitasalo, & Mets, 2004). During the TAG phase, the coach informed each participant about specific steps from the task analysis that would be "tagged." The coach selected steps that each participant had failed to execute consistently; these were Step 7 for Dan and Steve, Step 5 for Logan, and Steps 5, 6, and 7 for Russ. Immediately after observing a participant perform the step correctly, the coach sounded a bullhorn that produced a siren lasting 1 s. All participants reported that they could hear the siren without difficulty. No additional feedback was given to the participants following the TAG pass-blocking drill nor were putative positive (e.g., praise) or negative backup reinforcers (e.g., avoidance of practicing the drill again) associated with the TAG procedure.

Game performance. None of the intervention procedures were implemented during the games.

Follow-up. We measured the pass blocking of Dan, Steve, and Russ when they returned for a second football season. Each participant was evaluated under baseline conditions, followed by intervention procedures that had been effective during the preceding season. Dan and Steve received descriptive feedback plus video feedback only, and Russ received descriptive feedback plus video feedback and TAG.

When they achieved an acceptable level of performance during practice pass-blocking drills, we conducted measurement from videotapes of a scheduled league game with a high school opponent. A different game was videotaped and measured with each participant (one game for Dan and Steve and two games for Russ).

Social Validity Assessment

At the conclusion of the first football season, the participants were asked to rate their satisfaction with the four phases they experienced during the study (baseline, descriptive feedback, descriptive feedback plus video feedback, and TAG). On a 1-page form, they entered one of four numerical ratings for each phase: 1 = *poor*, 2 = *fair*, 3 = *good*, 4 = *excellent*. Before presenting the form to the participants, the senior author reminded them about the procedures that comprised each phase of the study.

RESULTS

Figure 1 shows the percentage of pass-blocking steps executed correctly by each participant during practice drills and games. Mean correct pass blocking was 40% and 50% for Dan during the baseline and descriptive feedback phases, respectively. His performance improved under the video feedback condition ($M = 82\%$). Targeting Step 7 of the task analysis with the TAG procedure was associated with 100% correct pass blocking during drills. Mean blocking proficiency was 85% in game conditions. During the baseline at the start of the second season, his mean correct pass blocking returned to low levels ($M = 45\%$). Descriptive plus video feedback was effective in improving his pass blocking ($M = 80\%$), and this high proficiency was maintained during actual game observations ($M = 87\%$).

Mean correct pass blocking was 47% and 50% for Steve during the baseline and descriptive feedback conditions, respectively.

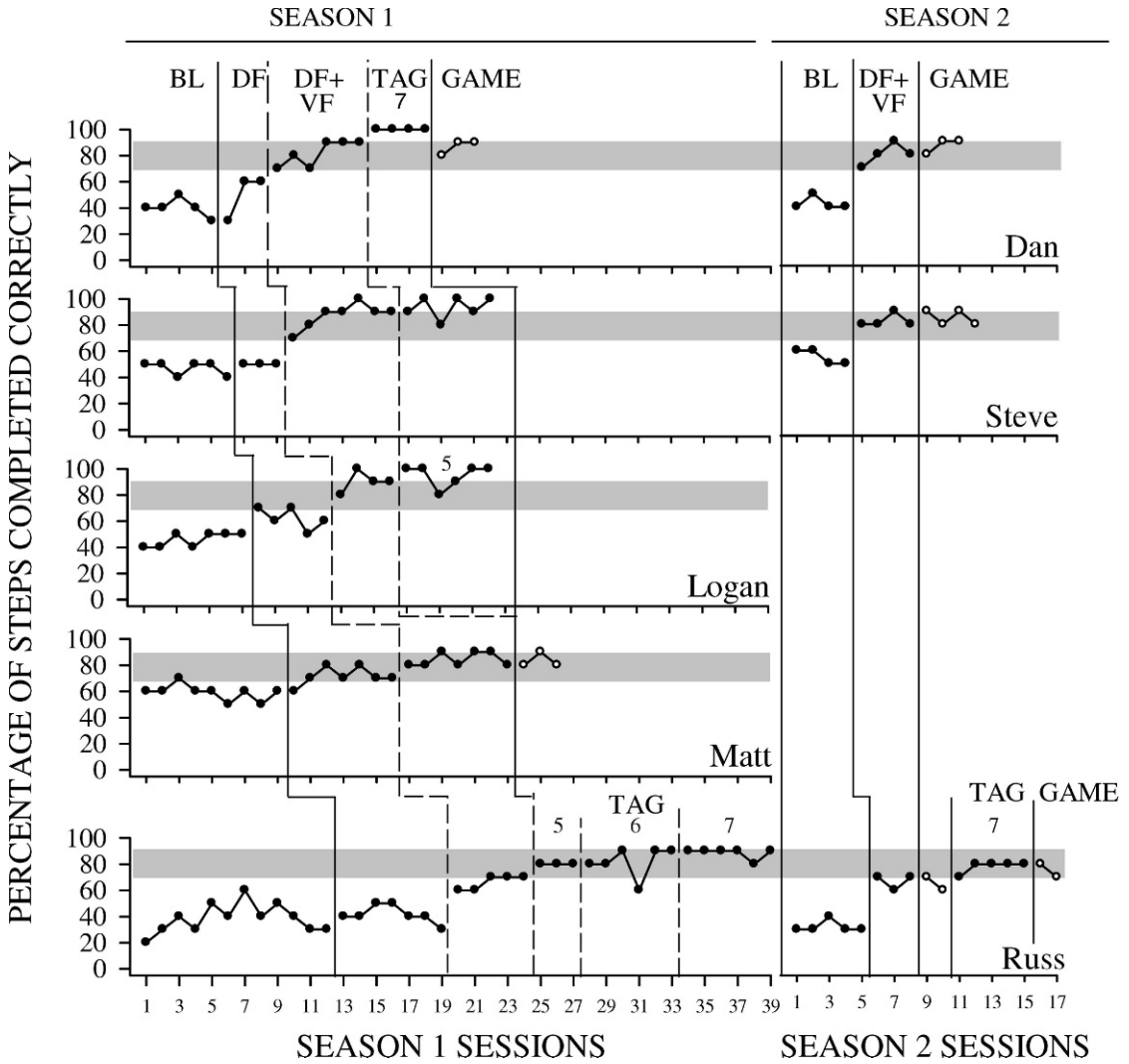


Figure 1. Percentage of pass-blocking steps executed correctly during practice drills and games across two seasons of high school football. The shaded horizontal lines represent the normative pass-blocking performance range of starting varsity linemen.

Correct performance increased with the provision of video feedback ($M = 87\%$). Effects of the TAG procedure targeting Step 7 of the task analysis are unclear; nevertheless, he achieved 100% correct in three of six pass-blocking drills during the TAG phase. When assessed at the start of the second season, correct pass blocking returned to low levels during baseline ($M = 55\%$). Reimplementing video feedback improved his performance ($M = 83\%$); subse-

quent in-game performance was strong ($M = 85\%$).

Mean correct pass blocking was 43% for Logan during the baseline phase. His performance improved initially with descriptive feedback but then decreased ($M = 62\%$). Adding video feedback increased correct pass blocking to a mean of 90%. Mean correct pass blocking was 95% with the TAG procedure in place for Step 5 of the task analysis.

Table 2
Social Validity Ratings of Behavioral Coaching Tactics

Condition	Participant					<i>M (SD)</i>
	Dan	Steve	Logan	Matt	Russ	
Baseline	1	1	1	1	1	1.0 (0)
Descriptive feedback	2	2	3	2	2	2.2 (0.45)
Descriptive feedback plus video feedback	4	4	4	4	3	3.8 (0.45)
TAG	3	3	2		4	3.0 (0.82)

Mean correct pass blocking was 59% for Matt during the baseline phase. Pass blocking appeared to improve with both descriptive ($M = 71\%$) and video ($M = 84\%$) feedback. Mean blocking proficiency was 83% under game conditions.

Russ demonstrated the most variability in pass-blocking execution during the initial baseline phase, ranging from 20% to 60% ($M = 38\%$). His performance did not improve with descriptive feedback ($M = 41\%$), but did improve with video feedback ($M = 66\%$). Further improvement occurred when the TAG procedure was implemented for Step 5 ($M = 80\%$), Step 6 ($M = 82\%$), and Step 7 ($M = 88\%$) of the task analysis. The second season baseline assessment showed a return to low levels of correct pass blocking ($M = 27\%$). Descriptive and video feedback were associated with improved performance ($M = 67\%$), which was maintained during games ($M = 65\%$). Because performance fell below the performance criterion, additional intervention was implemented (TAG of Step 7), yielding a mean performance of 78%. His correct pass blocking persisted during a second in-game measurement ($M = 77\%$).

At the close of our intervention, each participant was able to pass block consistently within our normative criterion that was established for starting offensive linemen. All participants achieved this criterion during the descriptive and video feedback phase; however, TAG allowed participants to exceed (Dan, Steve, Logan) or consistently stay within the criterion (Russ). Criterion performance persist-

ed for all of the participants who were assessed during games.

Table 2 presents the social validity results. All five participants rated the baseline coaching procedures as poor. They rated descriptive feedback as fair (80%) and good (20%), descriptive feedback plus video feedback as good (20%) and excellent (80%), and TAG as fair (25%), good (50%), and excellent (25%).

DISCUSSION

Descriptive feedback alone did not improve pass blocking. The descriptive and video feedback condition was demonstrated to be effective in improving correct pass blocking for all five participants. When four of the five participants received TAG, their correct blocking increased further, but the short assessment phases, the increasing trends in the data in preceding conditions, and the aggregation of the data make it difficult to isolate the specific effects of TAG. For all of the participants, improved pass blocking matched a normative standard for more experienced linemen, and this strong performance was evident in games. Finally, participants rated the coaching condition involving descriptive and video feedback most favorably.

Video feedback combined with descriptive feedback was consistently superior to descriptive feedback alone in improving pass blocking. This outcome is consistent with similar research conducted with swimmers (Hazen et al., 1990). One possible reason for the superiority of video feedback in the current study is that this condition included model prompts in addition

to the vocal prompts in the descriptive feedback condition, and these model prompts may be instrumental in developing proficient pass-blocking performances. Note, however, that the video feedback condition also required that the participants practice the entire 10-step blocking sequence one time after seeing themselves on videotape. Therefore, the question remains as to whether video feedback without this practice step would have had the same effect.

TAG involves the behavior-contingent presentation of an audible marker (Pryor, 1999). As noted previously, TAG is formally similar to concurrent feedback by which an auditory stimulus follows a target behavior that is demonstrated under real-time conditions (Konttinen *et al.*, 2004). In the present study, the effects of TAG may have influenced performance via different stimulus functions, such as (a) increasing the discriminative control of antecedent stimuli (e.g., movements of the rushing lineman's or the blocker's own behavior) or (b) strengthening precursor behaviors in the blocking sequence (e.g., feet position or body angle). Furthermore, the auditory stimulus in our study, a siren, may have become a conditioned reinforcer by virtue of its pairing with successful blocking and unprogrammed positive attention from teammates and the coach. One advantage of TAG in behavioral coaching is that it can be implemented at the precise moment in practice situations that require fluent execution of chained responses. For example, vocal prompting and feedback from the coach may not influence behavior during the actual blocking sequence due to the noisy and physically challenging pass-blocking drill conditions. By contrast, coaches can effectively mark participant-specific behaviors with the TAG procedure. Because strong inferences regarding the efficacy of TAG are not possible in this study, further evaluations are needed to determine whether TAG can be

recommended as an effective training method in football as well as in other sports.

We concentrated on pass blocking during weekly practice drills in this study. Performance during actual games was assessed with two participants during the first season and three participants who returned for a second season. These results demonstrated that the pass-blocking proficiency achieved during practice was maintained under game conditions. Observation of effective performance during actual game situations is a strength of the study. However, conclusions about practice-to-game performance must be tempered because the game samples were limited to three to four plays during one to two games and because we did not conduct preintervention game assessments for any of the participants (Smith & Ward, 2006; Ward & Carnes, 2002). Furthermore, not all of the participants' pass-blocking performance was measured during games. These limitations should be addressed in future behavioral coaching research concerned with the effects of practice-based interventions on performance during competitive events.

Using a behavioral consultation model (Kra-tochwill & Bergan, 1990), the senior author trained and monitored the coach's implementation of intervention procedures and his measurement of their relative effectiveness throughout regularly scheduled football practices during this study. Interobserver agreement assessments revealed that the coach reliably recorded data throughout the evaluation. Understanding the relation between components of behavioral coaching and proficient pass-blocking performance under these authentic conditions is another strength of our study. Future research should measure intervention integrity of coaches to ensure that procedures are implemented as described (Gresham, 1989) and to determine if different components are more or less difficult to implement under actual coaching conditions.

The dependent measure in our study was the percentage of pass-blocking steps executed correctly. However, our measurement system did not show whether acquiring these steps corresponded with successful pass-blocking outcomes. For example, a successful or unsuccessful block could be defined as a participant preventing the rushing defensive lineman from contacting the orange cone in practice or the quarterback in games. Or, another measure of successful pass blocking could be the distance a participant kept the rushing defensive lineman from the orange cone and the quarterback. Ultimately, improved pass blocking can be measured against game indexes such as the percentage of passes completed, total offensive yards, points scored, and wins. Our task analysis was selected to document whether intervention effectively taught young football athletes the basic skills necessary for proper pass-blocking execution (cf. Allison & Ayllon, 1980) but additional measures of successful blocking outcomes should be incorporated in future behavioral coaching research.

Although few behavioral coaching studies have reported social validity outcomes (Rogerson & Hrycaiko, 2002; Smith & Ward, 2006; Swain & Jones, 1995), the social acceptability of the various behavioral coaching tactics may be important to consider in addition to the efficacy of such tactics. Four of the five participants in the current study preferred video feedback over the other procedures, and the fifth participant rated TAG most highly. Consistent with other social validity research in which direct consumers' values of interventions are assessed, our participants preferred the conditions under which they were most effective (e.g., Hanley, Piazza, Fisher, & Maglieri, 2005; Heal, Hanley, & Layer, 2009). Of future interest is whether the most effective coaching methods are those judged most favorably by athletes and whether successful outcomes are consistent with or independent of players' preferences. In addition, social validity assess-

ments should incorporate dimensions of procedures used to improve performance that may influence preference. These variables may include whether procedures build on existing skills or attempt to teach novel skills, are simple or relatively complex, or make players stand out in the presence of teammates rather than being taught more discreetly. In addition to determining the players' values for behavioral coaching tactics, social validity assessment should be conducted with the coaches who implement them to identify the most acceptable training and practice procedures.

It is not uncommon to find poor postintervention maintenance associated with behavioral intervention in sports. As an illustration, Anderson and Kirkpatrick (2002) used several behavioral procedures to increase correct relay tags by three members of a competitive inline roller speed skating team. Six months following intervention, all of the skaters required additional training because they did not perform relay tags at the frequency achieved with intervention. Similarly, improved pass blocking was not maintained for the three participants in our study who returned for a second season. It is likely that each participant's pass-blocking skills deteriorated without routine practice and ongoing behavioral coaching. Their performance improved immediately when descriptive plus video feedback and TAG procedures were reimplemented. These results suggest that one way to promote maintenance is for coaches to conduct booster training sessions at the start of a new season.

In summary, we found that a behavioral coaching intervention that incorporated vocal, visual, and in some cases acoustical performance feedback improved offensive line pass-blocking skills of high school football athletes. The participants were able to perform at a level comparable to more experienced teammates and did so proficiently outside the practice sessions. They also rated most highly the intervention procedures that were effective for them. The

results of the study support previous findings on the benefits of behavioral coaching in football (Allison & Ayllon, 1980; Smith & Ward, 2006; Ward & Carnes, 2002) and an applied behavior-analytic approach to athletic performance enhancement (Martin, Thompson, & Regehr, 2004; Martin et al., 2005).

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