2019

The Use of Video Feedback to Enhance Performance in Collegiate Divers

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By

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B. S., Southern Illinois University, 2015

A Research Paper
Submitted in Partial Fulfillment of the Requirements for the
Master of Science in Education

Department of Kinesiology
in the Graduate School
Southern Illinois University Carbondale
December 2019

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November 15, 2019

TABLE OF CONTENTS

LIST OF TABLES

TABLE PAGE

CHAPTER 1

INTRODUCTION

Motor learning strategies are key factors that affect athletes' performance (Sigrist, Schellenberg, Rauter, Broggi, Riener, & Wolf, 2011). Coaching strategies have been identified as critical factors in developing expertise and elite-level performances in sports (Janelle, Barba, Frehlich, Tennant & Cauraugh, 1997). The highest-level performance can be achieved within the shortest time through the optimal learning strategies (Janelle, et al., 1997). Providing feedback to the learners on their actions is one of the most important strategies that influences the learning process (Liebermann, Katz, Hughes, Bartlett, McClements, & Franks, 2002). Moreover, augmented feedback is defined as the comments that learners receive about their performance (Ramos, et al., 2015). It provides additional information to learners even more than the inherent information that is instinctively available (Onate, Guskiewicz, Marshall, Giuliani, Yu, & Garrett, 2016). Learners are able to gain knowledge of the nature of the task from augmented feedback and it can correct and motivate learners in their learning process (Ramos, Esslinger, & Pyle, 2015).

Overview

Feedback is usually given either during the movement or after and may take several different forms, such as verbal, video, written and posted feedback (Horn, Scott, Williams, & Hodges, 2005). Vision supports the perception of human movement and is necessary for observational learning (Rodrigues, Ferracioli, & Denardi, 2010). Al-Abood, Davids, and Bennett (2001) have investigated the effectiveness of visual demonstrations as instructional constraints on the improvement of movement coordination. First, video demonstrations are frequently used to study the way visually perceived relative motion regulates the motor action (Rodrigues,

Ferracioli, & Denardi, 2010). According to Onate and colleagues (2016), video feedback is an especially unique approach as it allows participants to review their performance visionally, giving them a realistic image of their own performance. Another previous study shows that video feedback is commonly used in various sports settings and provides a training boost for both athletes and teams (Ives, Straub, & Shelly, 2002). In practice, films and videos have been used by individuals and teams for years, including athletes, coaches, and sport scientists to obtain helpful feedback from analyzing videos of live action and training, and thus improve technical performances and training strategies (Ives, et al., 2002; Cassidy, Stanley, & Bartlett, 2006). Moreover, videos are effective tools for assessing and improving performance in areas related to psychology, such as coaching communication (Cassidy, et al., 2006). Onate and colleagues (2016) argued that video feedback has been used successfully in teaching, learning, and for peer feedback. It has been commonly used among learners and provides a much better format than other types of feedback (Vrbik, Kristicevie, Sporis, & Madic, 2015). Other advantages of video learning include the benefit that learners can gain when they receive instructional information during training, and video files can be stored and replayed at the practitioners' convenience as a permanent record (Adliah, Tee, Thomas, Mohd, Nur, Shariza, Norazrina, Endang, & Siti, 2012). Additionally, motor learning on different tasks can be facilitated when learners receive augmented feedback and video demonstration (Vrbik, et al., 2015). Video recordings are able to provide a visual feedback in a powerful way and it is possible to support learning in multiple ways compared to other methods such as demonstrations (Boyer, Miltenberger, Batsche, & Fogel, 2009).

CHAPTER 2

REVIEW OF LITERATURE

This literature review selects two studies to investigate the effectiveness of video feedback in complex skills, which have similar body movements and positions in diving, and both studies show better improvements in the video model group. The results support the main hypothesis of this paper. Some other articles are selected to explain the process of how people make decisions and act properly through visual perception. For example, perceptual decision making is an essential and important aspect in diving as it requires fast reactions of body movements. Understanding this background will help demonstrate how video feedback affects athletes' performance. Video feedback not only affects athletes' performance, but also helps in coaching strategies for better interaction with athletes. By popularizing this technique, coaching quality can be largely improved in sports.

A Case of Study

Sigrist, et al., (2011) stated that using a modeling demonstration promotes the motor learning process, compared to the instruction with no modeling demonstration. Few studies have shown the effectiveness of video feedback in the performance of complex skills in sports that require complex body movements and positions, such as diving (Ramos, et al., 2015). Sigrist, et al. (2011), asked participants to perform a pirouette, a highly complex skill in classical ballet. This task was chosen because of its complexity. This long learning process was expected to show an improvement during the initial phase. Participants in the video feedback group watched a model's pirouette demonstration in a video clip while the point-light group watched the same video clip but with only point lights showed on a black background. As expected, the performance scores of both groups showed an observable improvement during the practice.

Nonetheless, the video group showed a significantly greater improvement compared to the point-light group based on the professional judgments.

Perceptual Decision Making and Cognition

According to Garcia-Gonzales, Moreno, Gil, and Villar (2013), many skills can be used for recognizing and judging situations, in order to make decisions properly. This process is called perceptual decision-making (PDM), which is based primarily on visual perception. PDM is a primary element in reactions of high-level skills, such as returning a serve in tennis, blocking shots-on-goal in hockey or soccer, or hitting a pitched baseball (Fadde, 2006). It is also an important aspect in diving, since the movements of diving are complex and require fast and appropriate responses. However, even though PDM is considered a primary element in high-level performance, it comes from instinct and experience rather than systematic teaching (Fadde, 2006). In other words, it is not a skill that is taught, but may be trained (Gonzalez et al., 2013). An example from Fadde (2006) in math, the purpose of PDM training is to gain the skill that responds automatically to the stimulus rather than to consciously calculate. The optimal way to build the skill of automatic response is drill and practice. The same way that drills are used in sports to build specific muscle groups. Training that targets PDM could help the performance learners to develop faster response speed.

Alexander, Fernando, Luis, and Alberto, (2015) stated that the knowledge stored in an athlete's memory can affect his or her cognitive processes. The athlete gains knowledge from a practical context that is mainly on the learner's reaction with the environment and tasks. Hence, the knowledge influences the PDM that the greater varied knowledge is gained, the better decisions will be made (Miletic, Jelicic, & Oreb, 2007). As knowledge increases, it is able to develop in the long-term memory, where a cognitive skill can be used for assessing current

situations and making the optimal decision. This type of knowledge is used to process important information about real-time situations, to make decisions, responses, and to adapt the execution during the competition.

Alexander et al. (2015) has emphasized the development of cognitive processes by individuals receiving video feedback of their actions and verbal knowledge that the individuals have evaluated for response in their sport fields. They found that through video feedback, athletes were able to view their movements, and recognize the advantages and disadvantages of the other teams, as well as to identify environmental factors. Generally, incidents occur too quickly for the athletes to interpret all information cognitively in sports. The wide range of use in video feedback has been found effective for cognitive expertise development. It is able to simulate various types of situations for practice. Previous studies have shown that the most recommended time for using of video feedback to optimize cognitive expertise is 24–48 hours after competition in laboratory condition. The use of video feedback benefits training strategies by enhancing cognitive knowledge in athletes. Diving is another example, as cognition and PDM play important roles during divers' performance. Through video feedback, divers are able to observe their body positions, the timing movements in each phase, and their personal strengths and weaknesses. This type of tool can give divers perceptual feedback immediately after every dive/practice.

Video Strategy in Coaching

According to Ives, et al., (2002), video feedback can help coaches communicate more effectively with athletes. Coaches are able to play the videos to athletes individually (Januario, & Rosado, 2013). This is a great opportunity for interaction between both coaches and players during the video observation, which is a major factor for improving communication. For

instance, a hockey team from a NCAA Division I school films all games as a resource when coaches provide instructional feedback. Coaches use videos to help identify the weakness of athletes, review athletes who were struggling with certain techniques, and evaluate if athletes are performing new techniques. In general, coaches only show the videos to the athletes. As a result, athletes reported that the clips were the most important in helping them improve their play, including increasing awareness of those areas needing improvement, coach-athlete trust, and belief in their improvement. However, video training promoted better interaction between coaches and athletes, which built better communication and boosted motivation for performance (Luiselli, Woods, & Reed, 2011).

The purpose of this study is to investigate the effect of video feedback for collegiate divers on their performance. The hypothesis is that the divers who received video feedback will have a more significant improvement in their performance than the divers who received only verbal feedback.

Definition of terms: 103B defines as a front one-and-half somersault dive with pike position.

CHAPTER 3

METHODS

Participants

A total of eight collegiate divers between age of 19-22 participated in this study, six of them (four female and two male divers) were from the diving team at Southern Illinois University (SIU) and two female divers were from Indiana State University (ISU). All participants volunteered for this study and signed an informed consent approved by Southern Illinois University Human Subject Committee.

Instrument

The study took place at an on-campus diving pool for both Universities. A 3-meter springboard was used by participants to perform their dives. An Ipad Air 2 was used for recording and displaying participants' performance. A notebook was also used to record dive scores after each participant performed.

Procedure

All participants completed the research activities during their normal daily training time. When they were performing, the SIU diving coach was assisting in this study by judging scores for the participants at SIU on each trial and recording the scores in a notebook as the ISU coach was judging scores for the participants at ISU. The coaches gave a normal verbal feedback to all participants and were not told what type of feedback the participants were supposed to receive. The participants used 3-meter springboards to present their dives during this study. All eight divers performed the same dive, a front one-and-half somersault dive with pike position (103B) throughout the experiment. Prior to the start of the study, the participants were given detailed instructions of the entire process and after which any questions were answered. Next, all

participants had 30 minutes for warm up (e.g. stretching, basic dives). After 30 minutes, they were assigned to either receive verbal feedback and videotape feedback from Ipad or only verbal feedback from the coach after each dive.

Four participants performed their dives first, and the coaches judged the dives, and gave scores for those dives they just performed, and recorded the scores in the notebook. After that, the coaches gave them verbal feedback, which was a normal feedback with corrections to guide them what they should do to get better on the next trial. On every trial, the divers watched the video clips from Ipad right after they received verbal feedback, which played the dive they just performed. Each individual repeated five trials on a day.

The other four participants performed the same dives as the other group did. The coaches also judged the dives, scored each dive, and recorded in the notebook after they performed. The participants in this group only received a normal verbal feedback with corrections to help them get better on the next trial that the other group also received the same type of feedback. However, the participants in this group did not receive video feedback. Each individual repeated five trials on a day.

In this study, each diver performed 5 trials a day and repeated the same process for five days. The experimental process was the same at both universities. In this study, the dependent variable was the scores that changed based on the two different conditions (verbal feedback verses verbal and videotape feedback). SPSS was used for statistical analysis. The data of two conditions of five trials over five days were analyzed using a 2x5x5 repeated measures analysis of variance (ANOVA) and then the same analysis was conducted with ‘Years of diving’ as a co-variate to testify the influences in an average of five days performance. The level of significance was set at $p \leq 0.05$.

CHAPTER 4

RESULTS

The purpose of this study was to investigate if video feedback is able to promote performance enhancement in collegiate divers. It was hypothesized that there would be a significant difference between the 'verbal and video feedback group' and 'verbal feedback only group'. The verbal and video feedback group were expected to improve more than the verbal feedback only group. The results show a statistically significant difference between the two group means as determined by repeated measures ANOVA (F= 8.213, P = .029). In analyzing the average of these groups' performance over a five-day period, the participants who received both verbal and video feedback performed (M= 7.1413) significantly better than the participants who received only verbal feedback (M= 6.3000).

Table 1: Participant Characteristics

Diver	Group	Gender	Age	Years of diving
1	verbal	F	19	5
2	verbal	F	20	10
3	verbal	M	19	4
4	verbal	F	19	3
5	Verbal + Video	F	20	10
6	Verbal + Video	M	19	8
7	Verbal + Video	F	21	9
8	Verbal + Video	F	19	6

Table 2: Average of Two Groups' Performance Over a Five-Day Period

Univariate Analysis of Variance

Between-Subjects Factors

		Value Label	N
training_condition	1	oral	4
	2	oral + video	4

Descriptive Statistics

Dependent Variable: FiveDay_Ave

training_condition	Mean	Std. Deviation	N
oral	6.3000	.39531	4
oral + video	7.1413	.43406	4
Total	6.7206	.59154	8

Tests of Between-Subjects Effects

Dependent Variable: FiveDay_Ave

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.415[a]	1	1.415	8.213	.029
Intercept	361.334	1	361.334	2096.680	.000
training_condition	1.415	1	1.415	8.213	.029
Error	1.034	6	.172		
Total	363.784	8			
Corrected Total	2.449	7			

a. R Squared = .578 (Adjusted R Squared = .507)

However, it has been noticed that the participants in the group of verbal and video condition had more experience in diving on average. Therefore, the same analysis was conducted with ‘Years of diving’ as a co-variate to testify the influences of it on the result. This analysis revealed no significant difference associated with the co-variate (F= .044, *P*= .842), which means when controlling for diving experience, the method used for training did not lead to significant differences in performance. It is possible that the differences in performance between the two

training groups that were observed previously were due to the duration of their diving experience.

Table 3: Mean and Standard Deviation of the diving scores of each group each day

	Verbal		**Verbal + Video**	
Day	Mean	SD	Mean	SD
1	6.025	0.78597911	6.775	0.8807144
2	6.15	0.6901564	7.175	0.59105169
3	6.3	0.8491482	7.05	0.7591547
4	6.375	0.84097375	7.175	0.466651
5	6.625	0.7411762	7.575	0.437547

Table 4: Average of a Five-Day Performance with Year of Diving

Between-Subjects Factors

		Value Label	N
training_condition	1	oral	4
	2	oral + video	4

Descriptive Statistics

Dependent Variable: FiveDay_Ave

training_condition	Mean	Std. Deviation	N
oral	6.3000	.39531	4
oral + video	7.1413	.43406	4
Total	6.7206	.59154	8

Tests of Between-Subjects Effects

Dependent Variable: FiveDay_Ave

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.607[a]	2	.803	4.768	.069
Intercept	28.194	1	28.194	167.320	.000
Yearsofdiving	.192	1	.192	1.137	.335
training_condition	.595	1	.595	3.530	.119
Error	.843	5	.169		
Total	363.784	8			
Corrected Total	2.449	7			

a. R Squared = .656 (Adjusted R Squared = .518)

Moreover, another test was run to analyze the growth in average score by subtracting average performances on Day 1-2 from the average performances on Day 4-5 for all participants, and no significant difference was found in this test (F= .006, P= .939)

Table 5: The Growth in Score Between Day 1-2 and Day 4-5 Performances.

Univariate Analysis of Variance

Between-Subjects Factors

		Value Label	N
training_condition	1	oral	4
	2	oral + video	4

Descriptive Statistics

Dependent Variable: Growth_Ave

training_condition	Mean	Std. Deviation	N
oral	.4000	.33417	4
oral + video	.3847	.19102	4
Total	.3924	.25212	8

Tests of Between-Subjects Effects

Dependent Variable: Growth_Ave

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.000[a]	1	.000	.006	.939
Intercept	1.232	1	1.232	16.625	.007
training_condition	.000	1	.000	.006	.939
Error	.444	6	.074		
Total	1.677	8			
Corrected Total	.445	7			

a. R Squared = .001 (Adjusted R Squared = -.165)

In addition, the same analysis of the growth in score between Day 1-2 and Day 4-5 performances was run by including 'Years of diving' as a co-variate to control it. The outcome of this test showed that there is no significant difference in this analysis as well (F= .006, *P*= .939). Hence, it confirms that the experience on diving did not affect the results.

Table 6: The Growth in Score Between Day 1-2 and Day 4-5 Performances with Year of Diving

Univariate Analysis of Variance

Between-Subjects Factors

		Value Label	N
training_condition	1	oral	4
	2	oral + video	4

Descriptive Statistics

Dependent Variable: Growth_Ave

training_condition	Mean	Std. Deviation	N
oral	.4000	.33417	4
oral + video	.3847	.19102	4
Total	.3924	.25212	8

Tests of Between-Subjects Effects

Dependent Variable: Growth_Ave

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.023[a]	2	.011	.133	.878
Intercept	.227	1	.227	2.682	.162
Yearsofdiving	.022	1	.022	.261	.631
training_condition	.004	1	.004	.044	.842
Error	.422	5	.084		
Total	1.677	8			
Corrected Total	.445	7			

a. R Squared = .051 (Adjusted R Squared = -.329)

CHAPTER 5

DISCUSSION

From previous research, it can be determined that using video feedback in training program helps increase athletes' ability for analyzing in real-game situation (Alexander et al. 2015). Athletes are able to find out strengths and weaknesses of other teams and also gain the ability to identify contextual factors from observing video feedback (Alexander et al. 2015). Video demonstration plays an important role in sports as it is identified as the most optimal perceptual motor training strategy. It is frequently used to train for decision-making and perceptual skills, and to show the video images and quantitative information, such as distance and angles (Ives, et al., 2002; Cassidy, et al. 2006). However, video feedback has been used successfully in motor learning as it is able to provide a powerful, visual ways than verbal feedback. The study in this paper found that the improvement in average scores on the overall five-day performance for the verbal and video feedback group were significantly higher than the verbal only group. In addition, no significant differences were found in the growth in average score by subtracting average performances on Day 1-2 from the average performances on Day 4-5. Lastly, there were no significant differences when the analysis was conducted with 'Years of diving', therefore, their diving performance was not controlled by the duration of diving experience.

The effects and benefits of video feedback were seen in this five-day performance track. Although there was a difference between the results of the two groups, no significant difference was found in the last two days of performance. However, in a five-day performance, improvement could be seen among the scores in the verbal and video feedback group but without statistical significance. The reason that no significant improvement could be found in the last two

days remains unclear. However, there were several potential explanations for this finding. First, in order to avoid a potential interference on the coach's judgement, diving coaches gave normal feedback to all participants and were not aware of what types of feedback the participants were receiving during the experiment. However, diving is such a subjective sport. Judging dives and giving scores could vary by different coaches and in different circumstances. Coaches would judge differently based on their own opinions, even the same judge may have various opinions and scores on a dive with different trials. It was possible that in this study, there might be variance between the participants' performances and the scores given by the coaches. For instance, a diver received a score of 7 on the first trial of his/her dive, and he/she performed relatively better on the second trial, but the coaches might think which would not be worth to give a higher score of 7.5 even there was an improvement. Since the data in this study was analyzed by scores, it was possible that some improvements are not reflected in scores.

Secondly, in order to make their performance more even in each group, the participants were assigned into groups and they were aware of the allocation for not just themselves but all participants. This might result in both conscious and unintended competition as the participants knows in which group each participant belongs. Moreover, since the two groups performed concurrently, there was a possibility for the participant to observe the performance from other participants which helped contribute to a better performance. Additionally, participants could also observe others while they were waiting for the next trial, contributing to motor learning and possibly be better to process and correct their dives (Samija, Vrbik, Madic, & Sporis, 2015). These factors could all potentially be interferences to their performance other than the feedback.

There were some limitations in this study. First, the sample size was too small as only eight participants were involved in this study. This increased the possibility and the extend of an

error skewing the results, and it could be difficult to observe a difference between the groups. Second, the period of this experiment might be too short. Since diving is such a complex sport and the data was relied on the dive scores, it would be more difficult to find a significant difference from those scores during a short period of time like this study. Finally, the difference in the diver's experience of diving and levels of performance between participants would also affect the results. In this study, even though the participants were all collegiate students and at similar ages, their duration of experience varies from three years to ten years, and thus their levels of diving performance. This would possibly affect the learning capacity of the participants and thus progress towards the results. In future study, it would be suggested to have groups performing at different times in order to avoid the observation from each other. In addition, analyzing the number of corrections they make would be more accurate then dive scores as scores are subjective and could easily varies by judges. Finally, limiting years of diving and level of performance on participants could be another way to help eliminating bias in the results.

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Research Paper Title:
The Use of Video Feedback to Enhance Performance in Collegiate Divers

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