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THE EFFECT OF VIDEO AND POINT-LIGHT DEMONSTRATION ON MOTOR LEARNING AND PERFORMANCE

UČINEK PRIKAZA S POMOČJO VIDEA IN SVETLOBNIH TOČK NA MOTORIČNO UČENJE IN USPEŠNOST

ABSTRACT

The aim of the study was to investigate the effects of observational learning using video and point-light demonstration (manipulating the number of point lights) on the learning of free throwing in basketball. Thirty novice healthy students aged 12 to 14 years participated in the study. After a pre-test, the participants were randomly distributed into three groups: one modelling a video pattern, one group of four point lights and a third group of seven point lights (each group n=10). Performance accuracy results via the AHHPERD test as a measure of learning in pre-test, acquisition, retention and transfer were used. Analysing data using a one-way ANOVA and repeated measures (α=0.05) showed that training had a significant effect on the acquisition and retention, but there was no significant difference concerning the effectiveness of the three training methods used in the research. Therefore, the study revealed no significant difference in modelling type (video vs. point light) and amount (4 points vs. 7 points) on free throwing in basketball in teenage boys.

Key words: observational learning, video demonstration, point-light demonstration, basketball free throwing

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IZVLEČEK

Cilj raziskave je bil preučiti učinke učenja z opazovanjem, pri katerem se uporabijo video predstavitev in svetlobne točke (različno število nastavljivih svetlobnih točk) na učenje prostega meta v košarki. V raziskavi je sodelovalo 30 zdravih učencev, starih od 12 do 14 let. Po predhodnem testiranju so bili udeleženci naključno razporejeni v tri skupine, in sicer v skupino, ki si je ogledala video, in dve skupini, ki sta si ogledali prikaz s 4 in 7 svetlobnimi točkami (vsaka skupina N=10). Uporabili smo rezultate testa AHHPERD za preverjanje natančnosti meta kot merilo učenja v predhodnem testiranju, osvajanju znanja, pomnjenju in prenosu znanja. Podatke smo analizirali z enosmerno ANOVO za ponovljene meritve (α=0,05) in pokazali, da trening pomembno vpliva na osvajanje znanja in pomnjenje, ni bilo pa pomembne razlike pri učinku treh trenažnih metod, uporabljenih v raziskavi. Zato zadnja raziskava ni pokazala pomembnih razlik glede na vrsto modeliranja (video prikaz v primerjavi s svetlobnimi točkami) in količino (4 točke v primerjavi s 7 točkami) pri prostem metu v košarki, ki so ga izvajali najstniki.

Ključne besede: učenje z opazovanjem, video prikaz, prikaz s svetlobnimi točkami, prosti met pri košarki

INTRODUCTION

It is beyond doubt that one of the most important factors in the learning process is demonstrating skill. The demonstration of skill is one of the most powerful tools physical education teachers can use to convey skill-related information to a learner in a short time. A physical education teacher or coach displays skills because they believe that demonstrating a skill rather than mere verbal descriptions gives more information to learners in a short period (Hatami, Tahmasbi, & Shahmir, 2011). Modelling is an educational method which includes demonstrating a skill to increase the usefulness of learning. Therefore, modelling has also been introduced as observational learning (Schmidt & Wrisberg, 2004). One well-known theory in relation to the effects of modelling on the learning of skills is Bandura's social cognitive theory. This theory is based on the two-stage effects of the model of an observer that includes acquisition and performance. In the acquisition stage, an observer takes on processes such as attention and maintenance, and in the performance stage processes such as motivation and reconstruction. Accordingly, when looking through the components involved in the model an observer can acquire a motor memory that is used to match actual practice (Shafizadeh, 2010).

Considerable research has indicated observational learning domains demonstrating skills are an effective method for acquiring information and learning motor skills, strategies, plans and motor programmes (Wesch, Law, & Hall, 2007). A review of the literature suggests that the observation of a model can improve the results and form of the performance (Ferrari, 1996; McCullagh & Weiss, 2001; Sidaway & Hand, 1993), develop the ability to recall the movement patterns and detect error (McCullagh, Burch, & Siegel, 1990), the symbolic coding of physical activities (Carroll & Bandura, 1985), and the timing of motor sequences (McCullagh & Caird, 1990).

There are various methods such as live patterning (a pattern of those experienced and beginners), patterning clips (videos and photos) and patterning computer (animation) to help learners through the observational learning process that will result in the consolidation of a representation memory (Ghavami, Hosseini, Mohamadzadeh, Maleki, & Borhani, 2012). However, one of patterning problems, especially for beginners, is capacity constraints on information processing. Since the display of skill presents the observer with a lot of information, a person may not be able to obtain relevant information about movement, and their information-processing capacity becomes saturated with redundant and unusable information (Schmidt & Wrisberg, 2004). On the other hand, based on the visual perception viewpoint of observational learning of Scully and Newell (1985), educators and researchers have to provide the necessary information to learn through the observational learning process. Accordingly, they expressed that an observation can be part of the modelled body so that a beginner can establish a coordinated pattern of good information. These observations provide spatial and temporal information to observers related to the organs and joints involved in the movement. Scully and Newell's method (1985) infers that reducing the ratio of motor information to the essential elements should lead to improved motor skill acquisition due to the increased salience of information (Runenson, 1984, cited from Ste-Marie et al. 2012). Demonstrating light points is one of the techniques in which, by reducing the visual display and presentation through parts of the body in motion, the information needed is provided to allow the observer to identify the motor patterns (Johansson, 1973, 1975 cited from Ste-Marie et al. 2012). In other words, a model is a method providing relative information about the movement which is being observed. The first question that arose was whether this model compared with the model or models to display live video (expert and novice) would

perform better in terms of the learning and acquisition of motor skills. Scully and Carnegie (1998) compared the effects of a light-point model with a video model on learning ballet. Their results showed that those who practised with a light-point model were not only able to effectively learn ballet steps, but did better than the group that had been watching the video model (Scully & Carnegie, 1998). The results of studies on the learning skills of ballet (Rodrigues, Ferracioli, & Denardi, 2010), and dribbling a basketball (Romack & Briggs, 1995) also showed that the model is more effective than the video model. However, some research did not confirm the above results, with Al-Abood et al. (2001), Breslin et al. (2005) and Munzert et al. (2010) reporting that a video display is more effective than a light-point model. For example, Breslin et al. (2005) conducted research on the learning skills of throwing in cricket; no significant difference was observed between a light-point model and a video model.

In a review, Ste-Marie et al. (2012) stated that several studies comparing different modelling methods and observational learning have been conducted to compare different methods of light-point modelling, live models, video models and animated models. For example, there were no significant differences between a live model and an animated model (Kampiotis & Theodorakou, 2006), live models and synthetic models (Kernodle, McKethan, & Rabinowitz, 2008) and a live model and a video model (Feltz, Landers, & Raeder, 1979). The researchers noted that studies relevant to observational learning should be directed towards the amount of information presentation through patterning models (Ste-Marie et al. 2012). Some people believe that a light-point model, especially one showing detailed markings, can lead to a consistent pattern in people. For example, with a light point on the toe joint for tapping toes (Hodges, Hayes, Eaves, Horn, & Williams, 2006) or a light point on the wrist joint for throwing a bowling ball (Hayes, Hodges, Scott, Horn, & Williams, 2007) the use of the information from observational patterning will suffice. In fact, the amount of information presented through the light-point model (several light points) is one of the controversial issues in this field. According to a literature review of research conducted in the country, no study was found comparing the amount of information presentation provided by a model, video patterning and a light-point model. Given the importance of choosing the best and most efficient way of using different methods of patterning in observational learning, as well as the conflicting results in this area, this study attempts to answer a question with regard to learning the skills of a free throw in basketball; namely, is there a difference in a patterning video and a light-point model in terms of changes in the amount of information presentation through the manipulation of light points?

METHOD

Participants

This study was a quasi-experimental design that involved pre-test, test, acquisition, retention and transfer tests. Boys aged 12 to 14 years were included in the study. They did not have any practice or experience with basketball. Thirty individuals volunteered and were randomly divided into three groups of 10 (an observation group of skilled pattern, an unskilled pattern, a pattern of light points). It should be noted that all subjects were right-handed.

Apparatus

Data were collected through fieldwork techniques. Data collected from the questionnaire were used for personal information and the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) test was used for free throwing a basketball. The data collecting methods included:

A) Questionnaires

A personal and sport information questionnaire, the Edinburgh Handedness Inventory, a questionnaire for collecting information on the participants' age and sports records in which the face validity of the questionnaire was approved by three physical education and sport sciences professors. The validity of the Handedness Inventory (93/0 = α) has been established (Williams, 1991).

B) The AAHPERD basketball free-throwing test

This test is a popular method for measuring the accuracy of the basketball free-throw skill. Grading of this test is as follows: 3 points for a goal without hitting the board or ring, 2 points for a goal that hits the board or ring, 1 point for no goal but where the ball hits the board or ring, and 0 point for no goal without hitting the board or ring (Rostami, Vaezmosavi, Bahram, & Kazemnezhad, 2010).

C) Camcorder

A Cannon digital camcorder (SX100) was used to build the light-point model. It was also used to mark the joints with LED lights with a five-millimetre diameter. Cinematography was done for all subjects on the sagittal plane and the right.

Procedures

Initially, in order to perform the test, considerations of all subjects were applied before practising based on Schmidt and Wrisberg's model (2004), which involves primary instruction and education for the skill of a basketball free throw and emphasising the important steps (Schmidt & Wrisberg, 2004). Then 10 trials were done as a pre-test and the results were put down on a record sheet. After ensuring the same level of expertise according to the subjects' pre-test scores, the participants were divided into three groups; a patterning model video, a seven-light-point model, and a four-light-point model. Participants were instructed in the following form. It is noted that over 6 sessions (in each session, 40 trials, and a total of 240 trials) all subjects went through acquisition sessions. After a review of previous research, the trials entailed practising in patterning the light-point model (Breslin et al. 2005; Rodrigues, Ferracioli, & Denardi, 2010). All of the subjects also watched a skilled teenage basketball player performing a basketball free throw whose performance had been approved by two college basketball experts and instructors. The subjects viewing the video model watched the performance of the skills through a 29-inch Samsung TV.

Cinematography and teaching people for the pattern with the light-point model entailed the skilled person's body being covered with a dark coating, which was filmed in two stages (to build the seven-point and four-point models). The seven-point model covers seven joints of the body including the shoulder, elbow, wrist, fingers, thumb, outer bone of the hip, knee, and ankle, whereas the four-point model only includes the joints of the shoulder, elbow, wrist, fingers, that

were marked using LEDs. Then the person was asked to show their basketball free throw skills in a dark room and this was filmed with a high zoom and a precise camera. The video film was then shown to the participants in the light-point model group.

The schedule of the training sessions was such that the first two minutes of the desired pattern was observed by the participants (the video model or light-point model) and then all subjects made basketball free throws in 40 trials. At all stages of the research, the subjects could only use feedback-induced knowledge of the result and no feedback was provided to them by the researcher (Breslin, Hodges & Williams, 2009). The ten points at the end of the last acquisition session (Session VI) were considered the subjects' acquisition scores. A retention test was performed after 48 hours of no training and a transfer test was performed in 10 trials in which the ball was thrown from the left side of the circle.

Data analysis was performed using descriptive and inferential statistics. First, the Kolmogorov-Smirnov test was employed to investigate the normality of the data, followed by a one-way ANOVA, multiple ANOVA with repeated measures (3*3), LSD post-hoc test. All statistical tests at the level of 0.05 were applied and were run using the SPSS software.

RESULTS

The participants' mean scores in the pre-test, acquisition, retention and transfer were analysed. Figure 1 shows the mean scores of the educational groups obtained in the three different stages of the research.

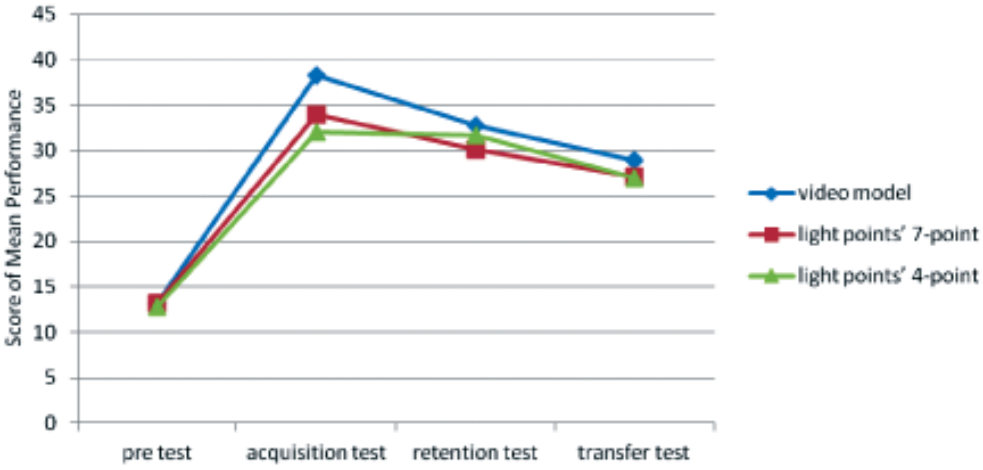

Figure 1. Score of the three groups' mean performance in the research processes

First, the normality of the data distribution in the studied groups was examined. The data showed that all three groups in the pre-test, test, acquisition, retention and transfer followed a normal distribution ($p<0.05$). Then a one-way ANOVA was used in the pre-test to compare the performance of the three groups. The results showed there was no significant difference between the three groups in the pre-test ($F=0.237$, $P= 0.79$). To view the interactive effect (pre-testing, acquisition, retention test) and practising groups (video model, seven-light-point model and

four-light-point model), MANOVA with repeated measures (3*3) was used. The results of these tests are given in Table 1.

Table 1. MANOVA statistical analyses for the three groups

Source	Sum of Squares	df	Mean Square	F	Sig
Test's	8213.647	2	4106.824	241.596	0.0001
Test's * Group	120.953	4	30.238	1.779	0.147

Table 1 shows that three groups were significantly different from pre-test to retention (F (2, 54) =241.596, P = 0.001). However, the interaction effect had no significant differences (F (4, 54) = 1.779, P = 0.147). There were also no significant differences in patterning methods between the video model, seven-light-point model and four-light-point model on the acquisition and retention of basketball free-throw skills.

After calculating the differences among the retention scores, the four-light-point group with smallest changes in performance (0.305±6.256) and then the seven-light-point group (3.775±2.828) and the video group (5.455±5.751) had a better retention of the pattern obtained, despite the one-way ANOVA revealing that these differences were not statistically significant (F (2, 27) = 2.579, P = 0.094). That is, the difference in scores among the three groups was not significantly significant (Table 2).

Table 2. Comparison of the three groups' mean performance from pre-test to transfer test

sig	F	Mean Squares	df		Variables
0.790	0.237	0.306	2	Between Group	**Pre-test**
		1.291	27	Within Group	
0.094	2.579	68.976	2	Between Group	**Retention***
		26.740	27	Within Group	
0.561	0.591	11.824	2	Between Group	**Transfer test**
		20.021	27	Within Group	

*Differences between retention test and acquisition test

Finally, in order to view the generalisation of the skills taught with the three training methods, the results of the transfer from a one-way ANOVA were analysed. The mean scores for the patterning group with the video model (28.911±3.314) were more than for the patterning group of the seven-light-point (27.091±5.697) and the four-light-point group (26.970±4.076). However, the results showed that no significant difference was found among the three groups in the transfer stage (F = 0.591, P = 0.561) (Table 2).

DISCUSSION

The main aim of the study was to assess the effect of the amount and type of information induced by the video model and the two light-point models on the performance and learning of the basketball free-throw skill in boys aged 12 to 14 years. Initial results of the analysis revealed no statistically significant differences in the three groups. Thus, the early level of proficiency in the three groups was the same. After 6 sessions and 240 training trials, the results showed that

the performance accuracy scores of the subjects had increased significantly in all three groups. These results are in line with the findings of previous research that studied the beneficial effects of observational learning (Ferrari, 1996; McCullagh & Weiss, 2001; Sidaway & Hand, 1993). It can be said that the present study also confirms a positive effect of patterning on the learning of motor skills.

Further, the results of the data analysis showed there is no significant difference between the patterning video model with the two light-point models (seven-point and four-point). In other words, there is no difference between the effect of practice with a patterning video and a patterning light-point model. The above results are in line with the findings of research performed by Al-Abood et al. (2001), Breslin et al. (2005), and Munzert et al. (2010) who found there is no significant difference between a video model and a light-point model. However, these results are not consistent with a number of previous studies that found a light-point model is better than a patterning video model (Scully & Carnegie, 1998; Rodrigues et al.. 2010; Romack & Briggs, 1995). In addition, they are not in line with the study by Hayes et al. (2007) who determined that the video model method is better than the light-point model method. In explaining the observed discrepancies between the findings of this study with those just mentioned it can be said that the effectiveness of different models of observational learning factors such as age, gender, skill level and the complexity of skills have an important role in motor learning. For example, Hayes et al. (2007) studied the bowling skills of children and adults via two methods of a patterning video and a light-point model. Researchers found no significant difference between these two methods; however, the children's light-point group was weaker than the group which had viewed the video model. Therefore, the difference in age and skill assessed in this study is one of the possible reasons (Breslin, Hodges, & Williams, 2009).

Part of the results showed there was no significant difference in the effectiveness of patterning between the seven-light-point model and the four-light-point model. This finding is in line with the study of Hodges et al. (2005) that found patterning lights with 1, 2 and 3 points had no significant difference on learning. Moreover, this finding is in line with Breslin, Hodges, & Williams (2009) who found there is no significant difference between patterning a light-point model for the whole body (17 points) and patterning a light-point model on four points of the body.

But this is inconsistent with research that suggests the presentation ratio of movement information via a number of light points can be demonstrated to a beginner, where the acquisition will affect the pattern of external and intra coordination. For example, Breslin et al. (2005) found a significant difference between a patterning one-light-point model with light-point model for the whole body (17 points) on learning throwing skills in cricket, where this difference was in favour of the 17-point model. The subjects of this study were young men and women who had no previous training in cricket. In addition, in another study Breslin et al. (2009) found that a patterning four-point model led to a more accurate performance than a single-point model on the throwing skills in cricket among beginners and novices. Yet some researchers have reported that providing relative information via a light-point model and only one point (tail-end organs involved) can establish the coordination pattern (Hayes et al. 2007, Hodges et al. 2006). In explaining the observed discrepancies between the findings of the study and the research cited above, the difference can be attributed to the amount of information as one possible reason. As an example, there were 17 light points rather than one light point in the study of Breslin et al. (2005, 2009) so the difference in the amount of information provided was considerable.

Overall, the purpose of this study was to address the presentation of movement information through observation. One idea was first raised by Newell and Scully (1985) (cited in Ste-Marie et al. 2012). As the performance comparison of the three groups of subjects showed, the patterning of the three ways depending on the amount and type of information that was provided does not differ much from learning skills for the basketball free throw. Therefore, Newell and Scully's (1985) viewpoint is supported by the present study. However, such a small number of subjects, the assessment of learning scores based on the accuracy of performance, and a single-sex survey only are among the limitations of the present study. Therefore, any generalisation of the present results should be made cautiously and, in future studies, researchers could compare the effectiveness of different models of patterning through an analysis of movement kinematics with the variability in the amount of information and on other athletic skills.

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