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The effects of Video Modeling on Children's Self-Regulation in Physical Education

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Video modeling is a type of observational learning that can influence students' motor skill development. The present study was designed to investigate the influence of video modeling on students' self-regulation in physical education classes. Two classes of 45 students (24 boys and 21 girls) aged 8 years were randomly assigned into two groups: the class that observed a video of an expert model performing the kick was the video modeling group; and the class that observed their teacher's performance was the live modeling group. Students were taught football skills, twice a week for four weeks. Before and after the intervention, students had to perform a kick in a soccer box. The use of self-regulation strategies during the tests was assessed through structured interview questions after performances. The statistical analysis showed that both groups developed their self-regulation abilities. The results of this study suggest that video modeling improves self-regulation in children and should be used by practitioners.

KEY WORDS: Video modeling, live modeling, self-regulation, early childhood, physical education.

Introduction

TEACHING FUNDAMENTAL SKILLS

The mastery of fundamental movement skills (FMS) is a vital component of the elementary school physical education program. FMS involves locomotor and manipulative skills (Gallahue et al., 2011). Children aged 7, 8, and 9 years old should have mastered the basic movement phase in FMS, as these skills are the foundation for more advanced sports skills (Goodway et al., 2019).

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However, researchers claim that elementary schools are unable to provide high-quality physical education experiences (Kirk, 2005), and as a result, children show an underperforming motor performance for their chronological age (Santos et al., 2020). Such problems in early childhood may affect participation in sports and physical activity, which promote a healthy lifestyle throughout life (Dapp et al., 2021; Stodden et al., 2012). Thus, high-quality instruction and the development of self-regulatory skills are important for achieving motor skill competence (Ommundsen & Lemyre, 2007).

A key component of high-quality instruction is the design and presentation of the learning tasks in an age-and developmentally appropriate manner (Chen et al., 2011) that meets the needs of students (Pangrazi & Beighle, 2019). For example, Colvin et al. (2016) suggest that kicking accuracy must be taught to 3rd grade students only after they have acquired kicking technique. Additionally, observational learning can be effectively used to present FMS in physical education classes.

Observational Learning

Observational learning is the learning process by watching the behavior of others. According to Bandura's social cognitive theory (1986), there are three basic models of observational learning: (a) a live model, which refers to an actual individual demonstration; (b) a verbal instructional model in which descriptions and explanations are presented; and (c) a symbolic model in which characters in books, movies, or online media could facilitate learning. Observational learning is facilitated by four factors: attention, retention, reproduction, and motivation (Han et al., 2022). These cognitive processes such as paying attention to, coding and retention of what is observed, and motivation to reproduce it can promote the acquisition of the skill performance (Han et al., 2022).

In the motor domain, two primary issues related to observational learning have been investigated. The first is about observing an expert/skilled model who provide correct information about performing an effective movement, and observers can use this information to organize and evaluate their own actions (Ste-Marie et al., 2012). The other is about observing a learning model that means a model who is not an expert. Which model observation expert or learning, is more effective has generated contradictory results. The first notion is that the observer would benefit from imitating the successful strategies of expert/skilled models (Lee & White, 1990). The second is that observers might gain knowledge from the error-correction process while observing a learning model, with researchers proposing that the problem-solving phase, which involves error detection and correction, can be skipped when the demonstration is optimal (Pollock & Lee, 1992).

Video Modeling

Video modeling is based on Bandura's social learning theory and the influence of a model on observational learning (Prelock, 2017) in which (a) a student watches a video before performing a skill; (b) the skill is demonstrated on screen by a model; (c) the educator prompts and reinforces students for attending to specific elements; and (d) the students are given opportunities to perform the skill displayed in the video (Nikopoulos & Keenan, 2006). This teaching strategy has a positive impact on the acquisition of motor skills (Obrusnikova & Cavalier, 2018; Zetou et al., 2002), and the benefits of it are greatest in the early stages of skill acquisition (Hayes et al., 2008).

Video modeling seems to improve the learning of basketball tactical actions (Rekik et al., 2019). Viewing the performance of an expert model has a more positive impact than verbal instruction in teaching the shooting skill in handball (Nahid et al., 2013) and the pass in volleyball (Barzouka et al., 2015). The retention of motor skills in volleyball is greater through video modeling than video self-modeling (Zetou et al., 2002).

In the early elementary school years, video modeling seems to be very effective for achieving the goals and objectives of youth physical education (Obrusnikova & Rattigan, 2016). Young players pay more attention to video demonstrations because they are attracted by images in motion (Ranker & Mills,2014). By watching expert athletes' performances on video, young/novice players can focus on specific elements of skills and pick up new moves and strategies (Kardas & O'Brien, 2018). Children's enjoyment of watching videos (Rekik et al., 2019) and their desire to perform just like the model enhances students' motivation to engage and persist in physical activities (Zetou et al., 2002). Through video modeling, educators have the opportunity to eliminate extraneous load (i.e., confusing instructions, extra information) (Rymal & Ste-Marie, 2019). As a result, the children's working memory is not overloaded, and their own learning is enhanced (Ibrahim et al., 2012). Additionally, this approach seems to be more beneficial because of its novelty to the learning environment (Charlop-Christy et al., 2000). Furthermore, video modeling facilitates the improvement of self-efficacy and perceived competence (Hoogerheide et al., 2014).

Compared to live modeling, video modeling is an interesting technique for learning a variety of skills because it requires little resources to implement. It can be implemented with less cost and little training time. Additionally, it can be reused until the desired scene is obtained, and each time the skill is demonstrated, the model need not be present (Charlop-Christy et al., 2000).

Self-regulation

The other factor that appears to maximize athletes' performance is their self-regulation processes (Wilson et al., 2021). It is believed that self-regulated students report higher intrinsic motivation, effort, and persistence during learning (Niemiec & Ryan, 2009). Self-regulated learning is organized in three phases: (i) in *forethought phase*, students analyze the task, set goals, and plan how to achieve them; (ii) in *performance phase*, students execute the task while monitoring their actions; and (iii) in *self-reflection phase,* students evaluate their actions, looking back and thinking what they should do to achieve their goals (Zimmerman, 2000).

Progress in self-regulation could be achieved in four steps: observation, imitation, self-control, and self-regulation. In other words, self-regulation comes from observational learning through modeling (Schunk & Zimmerman, 2007). Techniques such as goal setting, imagery, focus or motivation, self-monitoring, self-evaluation, and help-seeking are used by self-regulated students (Zimmerman & Kitsantas, 2005). Furthermore, research has shown that self-regulated players such as experts set process goals (i.e., "toss the ball properly") and use more specific techniques than non-experts or novices who set general-focus goals (i.e., "to concentrate") and use general techniques (Zimmerman, 2006).

Self-regulated students are motivationally, behaviorally, and metacognitively engaged in their own learning (Chatzipanteli et al., 2015; Zimmerman, 2000). In terms of metacognition, metacognitive knowledge and metacognitive skills are the two components of it. Metacognitive knowledge is defined as what (declarative), how (procedural), and when (conditional) a learner must use an appropriate strategy in a given task (Chatzipanteli, 2015). Metacognitive skills are about controlling learning through planning, monitoring, self-evaluation, and revising. Theorists claim that learners integrate metacognitive knowledge with metacognitive skills (Muijs & Bokhove, 2020). For example, students with procedural knowledge are more likely to select an appropriate strategy when planning or use a different type of strategy during revising to self-correct their performances. Research has shown that all children have some degree of self-regulatory abilities (Chatzipanteli et al., 2014).

In early childhood, children can exhibit metacognitive behaviors during problem-solving and the regulation of emotional and affective states. They are also able to understand the difference between difficult and easy items, and they can use simple steps to regulate their own learning. At the age of six, they can show conditional knowledge i.e., how to allocate their attention and apply simple metacognitive strategies such as memory monitoring when faced with challenging tasks (Chatzipanteli et al., 2014). Metacognitive monitoring and the use of metacognitive strategies are established mostly by children between the ages of seven and twelve (Weil et al., 2013).

Other findings suggest that even when students plan their actions, many of their plans are unsuccessful. This happens because tasks are often misunderstood or not given enough attention (Ambrose et al., 2010). Thus, students struggle to articulate their knowledge or transfer it to a new setting. In physical education, for example, after the acquisition of kicking technique third graders should be able to kicking for accuracy (Colvin et al., 2016). But the truth is that students do not kick as they should in game situations. This indicates that students have weaknesses in the application of declarative and procedural knowledge that means what and how to act in new situations (i.e., game situations).

According to DeKeyser (2007), declarative knowledge must be acquired through observation and/or by analyzing others' skilled behavior and then transformed into procedural knowledge. The combination of declarative and procedural knowledge (knowledge, skills and strategies) appears to guide effective performances in novel or problem-solving settings. Experts, for example, seem to pick up task-relevant information (declarative knowledge) more accurately than non-experts and apply it (procedural) during learning performance and problem-solving situations (Cleary & Zimmerman, 2001). One must develop meta-cognitive and self-regulating skills to have a good problem-solver as poor problem-solving abilities and failures to solve problems can result from poor meta-cognitive and self-management skills (Polya, 1945).

In the present study, students were given a problem-solving situation in which they had to goal kick a soccer ball within the box (1v1 with the goalkeeper) in order to identify (a) whether 8-year-old students use self-regulation strategies to control their learning, and (b) whether there is a difference between teaching through teacher demonstration and video modeling in adapting self-regulation strategies. It was hypothesized that 8-year-old students would use self-regulated strategies, including understanding and correcting specific technical errors. Regarding the second research question, no specific hypothesis was stated. We could not hypothesize which one of the two types of observational learning would help students choose appropriate strategies (i.e., specific and/or general-focus) so as to effectively perform the kicking.

Materials and Methods

Participants

The participants were 45 students, eight years old, from two elementary school classes in Greece. The two classes were randomly assigned using the lottery method: (i) one class served as the video modeling (VM) group, which included 25 students (14 boys and 11 girls); and (ii) the other class served as the live modeling (LM) group, consisting of 20 students (10 boys and 10 girls). Both student groups were football novices. Parents provided consent for student participation.

Two physical educators who were already teaching at the schools taught the intervention in their class. One teacher instructed the VM group, and similarly, the other teacher instructed the LM group. The intervention program took place during the school days.

Additionally, an a priori power analysis (G*Power 3.1; Faul et al., 2007) for ANOVA with repeated measures was performed to determine whether the study's sample size was suitable. Results revealed that a minimum of 34 participants would be required to achieve an expected moderate effect size of .25, a statistical power of .80 and a p value of less than .05. Similar criteria, to determine if the sample size was adequate, were also used by Kok et al. (2020), who examined the effects of self-controlled video feedback on motor learning and self-efficacy in a PE setting.

Procedure

The intervention occurred during the football skills instruction classes. More specifically, all participants were taught football skills twice a week for four weeks (40 minutes per lesson). Warm-up exercises were performed at the start of each lesson (about 5-7 minutes). Following that, both groups engaged in activities that required football skills such as passing, receiving a pass, shooting, dribbling, and goalkeeping (about 27-30 minutes) and then cool down exercises (5 minutes).

Before the first and after the last session of the four weeks, students were given a problem to solve; they were asked to kick a ball from a distance of 6 meters and score in a 1.5-meter soccer area box (1V1 with the goalkeeper). In the pre-test, the participants executed two physical attempts and then immediately responded individually to the researchers' questions for assessing self-regulation, and the same approach was followed in the post-test.

Students performed two trials before and after the intervention program so as to feel more comfortable regarding the distance and dimension of the soccer box and to organize their actions better before kicking the ball. This happened because researchers were more interested in seeing how students thought about picking up useful information (i.e., following through towards the target) or comprehending technical errors during the learning process in order to shoot within the box without the goalkeeper catching the ball.

To ensure the intervention fidelity, the following characteristics were observed by one qualified researcher in both groups during the whole intervention program: (a) adherence to an intervention, (b) exposure or dose, (c) quality of delivery, (d) participant responsiveness, (e) and program differentiation (Carroll et al., 2007). The researcher observed that the intervention program was delivered as it was designed by the researchers; the frequency and duration of the intervention was as advised by its designers; the teachers in both classes used the instructional strategies as demonstrated by the intervention program's designers; all the students from both groups participated in all the activities; and there was no differentiation to the intervention program by the teachers.

Intervention

During the intervention program, the VM group observed the execution of kicking through a video of a well-known player from a local football team in which the technical tips of the shot were verbally reported. Students were shown the model at real-time speed (four times; twice from the side angle and twice from the front angle), followed by a slow-motion demonstration (twice; once from the side angle and once from the front angle) in order to provide them a comprehensive understanding from different angles. The video presentation was given four times in total (once in the beginning of each week), at the start of each session. The first session lasted 4 minutes because students were novices to football and needed more time to learn and comprehend the kicking. As they gained more experience, the video time gradually decreased in subsequent courses.

To manipulate the speed of the skilled model video, the Slow Motion Video application was used to create the slow-motion video at 50% speed. This slow-motion version was saved to the laptop along with the original real-time demonstration speed video. The slow-motion video was provided because it appears to enhance basketball tactical actions (Jarraya et al., 2019).

Within the LM group, the demonstrations were provided in the same manner as in the VM group. The teacher (learning model) demonstrated the kicks four times at the beginning of each week (four times; twice from the side angle, twice from the front angle, and twice in slow motion) and described them verbally. Teachers in both groups did not provide feedback on the students' performance during the classes because the researchers wanted to see how the video and live modeling could help students perform accurately the kicking through recalling the correct sequence of the skill.

Interviews

Interviews were used for the assessment of children's self-regulation. Students, before and after the intervention, were asked to explain how they acted during the problem-solving situation according to the three phases of self-regulated learning (i) *forethought*, (ii) *performance*, and (iii) *self-reflection*, (Zimmerman, 2000)

1. *Forethought*: Before solving a problem, students try to understand and analyze the problem in order to choose a strategy and plan a solution.
2. *Performance:* During implementing the problem-solving plan students monitor their actions
3. *Self-reflection:* In this phase, students evaluate their actions, looking back and thinking what they should do to achieve their goals.

According to the aforementioned phases, a set of questions was developed (Table, I). The following questions were addressed to students twice (pre- and post-test), and researchers were blind when students replied to them, which means researchers did not know which group each participant was assigned to.

Furthermore, after the intervention program, students were asked one more open-ended question: "Do you think the video modeling/teacher demonstration helped you develop the kick? If so, in what way?", so as to inform the researchers which of the two techniques, or both, had an impact on students' motivational processes.

Assessment of Metacognitive Behavior

For the metacognitive behavior assessment, researchers have used Perkins' four levels of metacognition (1992) that a learner may use in the problem-solving process: tacit level, aware level, strategic level, and reflective use (Saddhono et al., 2019; Silby et al., 2015). At the *tacit*

TABLE I
Interview questions to assessing students' self-regulation

Planning	What was your goal? Did you have a plan before kicking the ball? What was your plan? What did you do?
Monitoring	When you kicked the ball, did you observe your movements? Maybe to find mistakes?
Evaluation/ Reflection	Was your plan good? How well did you do? What went wrong... did you achieve your goal? What could you do next time? Will you try something different?
To understand to what extent the video modeling or teacher demonstration helped the students to achieve their goals, one more question was added.	
After the intervention program	Do you think the video modeling/teacher demonstration helped you develop the kick? If so, in what way?

level, the students are not thinking about the decision they have taken. Students know about some kinds of thinking at the *aware level*, but thinking is not necessarily planned. Students can regulate their thinking at the *strategic level*, using general strategies that improve performance accuracy and help formulate problem-solving plans. At the higher level, the *reflective level*, students can reflect on their thinking before, after, or during the process and think about how to proceed and improve their actions by correcting errors or using specific strategies in the planning phase.

The last open-ended question, after the intervention program, was posed to examine students' motivational processes (i.e., task interest, motivation, attention) in regard to the video and live modeling.

Coding Scheme and Procedure

The interviews were recorded and then transcribed. The answers were coded by the two experts in qualitative research judgments, and students were categorized into the four metacognitive levels based on the "*Metacognitive Level Classification*" (Table II). The interviews were first coded qualitatively, and then they were converted into quantitative measures. Thus, students received points for each metacognitive indicator (planning, monitoring, and evaluating/reflection). For the tacit level of each indicator, 0 points; for the aware level of each indicator, 1 point; for the strategic level of each indicator, 2 points; and for the reflective level of each indicator, 3 points. Thus, a student who used metacognitive strategies at the reflective level for all indicators, was given 9 points. The Cohen's kappa coefficient of agreement (interrater reliability) showed high reliability in the planning phase (k =.93), monitoring phase (k =.82), and evaluation/reflection phase (k =.86).

Score calculation: Students performed two attempts before and after the intervention program. The first one was not calculated. Students received 1 point for each successful effort and 0 points for each unsuccessful attempt.

Table II
Metacognitive Level Classification

	Indicators of Problem Solving	Levels
Planning	Act without thinking	Tacit level (0 points)
	Know what the goals are but use the initial knowledge insufficiently in the given problem	Aware level (1 point)
	Understand the problem. Elaborate information, choosing a general technique strategy/ general focus strategy.	Strategic level (2 points)
	Elaborate on previous information in order to choose the most appropriate specific technique strategies/ specific focus strategies.	Reflective (3 points)
Monitoring	Do not consider the accuracy of the results.	Tacit level (0 points)
	Check their executions. Do not understand their errors completely.	Aware level (1 point)
	Identify sources of error, especially on general technique strategies/ general focus strategies.	Strategic level (2 points)
	Identify sources of error on general/specific technique strategies and general/specific focus strategies. Think about why the strategy is chosen does not work; designing the next step.	Reflective (3 points)
Evaluation/ reflection	Too far from the concept of the matter. "I do not know what improvements must be made. Answer questions such as "I do not know, I am not sure".	Tacit level (0 points)
	They assess their performance but provide inconsistent explanations. They report incomplete improvements which must be made.	Aware level (1 point)
	They assess their performance. They can explain most of what they are doing. They can apply general technique strategies/ general focus strategies.	Strategic level (2 points)
	They assess their performance and the use of the general and specific strategies used. They can identify how it was used correctly and revise it appropriately, designing what will be done.	Reflective (3 points)

Statistical Analysis

The normal distribution of the data was checked by calculating the z scores of skewness and kurtosis of each examined variable at both measurements (Kim, 2013). Results indicated that all variables, except monitoring at the pre-intervention measurement, had a normal distribution (*z* scores below 1.96 for samples with less 50 participants; Kim, 2013). Thus, researchers decided to use parametric tests for the next steps of statistical analyses. More specifically, descriptive statistics (mean and standard deviation) were calculated. Then, separate independent sample t-tests for the pre-intervention measurement were calculated in order to examine possible differences between the experimental and control groups on the examined variables (Planning, Monitoring, Evaluation, and Score). Separate 2x2 way analyses of variance (ANOVA) with repeated measures were used to investigate possible differences in the dependent variables (Planning, Monitoring, Evaluation, and Score) due to group (experimental, control), time (pre-, post-), and interaction between group and time. Sidak post hoc test was used to control for possible multiple comparisons between groups or time. Finally, paired sample t-tests were calculated to check for possible differences between pre- and post-measurements separately for the experimental and control groups. IBM SPSS Statistics version 26 was used to analyze all of the data, with the p-value set at .05.

Results

Normal Distribution and Descriptive Statistics

Descriptive statistics (mean, standard deviation), and *z* scores of skewness and kurtosis for pre- and post-intervention measurements are presented below in Table III.

Two-Way Anova With Repeated Measures

Planning Indicator

Two-way ANOVA with repeated measures showed a significant main effect of time ($F1,43 = 142.936$, $p < .001$, $\eta_p^2 = .769$), while there was no significant main effect of group ($F1,43 = .908$, $p = .346$, $\eta_p^2 = .021$) or time x group interaction ($F1,43 = 3.752$, $p = .059$, $\eta_p^2 = .080$) on Planning. Paired samples t-test revealed significant differences in Planning between pre- and post-intervention measurements for the experimental group ($t24 = -11.438$, $p < .001$, $d = .121$). Similarly, paired samples t-test showed significant differences in Planning between pre- and post-intervention measurements for the control group ($t19 = -6.097$, $p < .001$, $d = .080$). Mean scores showed that participants in both groups improved their scores on Planning at the post-intervention measure (Table IV).

Monitoring indicator

Similarly, there was a significant main effect of time ($F1,43 = 121.075$, $p < .001$, $\eta_p^2 = .738$), and a significant time x group interaction ($F1,43 = 14.648$, $p < .001$, $\eta_p^2 =$

TABLE III
Descriptive statistics (mean, standard deviation), and z scores of skewness and kurtosis for pre- and post-intervention measurements (total sample)

	Pre				Post			
Variables	**M**	**SD**	**Skewness**	**Kurtosis**	**M**	**SD**	**Skewness**	**Kurtosis**
Planning	1.76	.80	1.36	-1.83	2.67	.98	-.96	-1.14
Monitoring	1.60	.81	2.47	-1.28	2.56	.99	-.45	-1.37
Evaluation	1.67	.77	1.87	-1.41	2.78	.95	-1.48	-.72
Score	.60	.58	.91	-1.03	.89	.71	.47	-1.39

Notes. M = Mean; SD = Standard Deviation; Pre: Pre-intervention measurements; Post: Post-intervention measurement; M: Mean; SD: Standard Deviation; Skewness: *z* scores of Skewness; Kurtosis: *z* scores of Kurtosis.

TABLE IV
Means and standard deviations between VM and LM groups at the pre- and post-intervention measurements of the examined variables

	VM Group		LM Group	
Variables	**Pre (M±SD)**	**Post (M±SD)**	**Pre (M±SD)**	**Post (M±SD)**
Planning	1.80±.82 [a]	2.84±.90 [a]	1.70±.80 [b]	2.45±1.05 [b]
Monitoring	1.56±.82 [c]	2.80±.91 [c]	1.65±.81	2.25±.1.02
Evaluation	1.72±.79 [d]	3.08±.81 [d, f]	1.60±.75 [e]	2.40±.99 [e, f]
Score	.60±.57 [g]	1.04±.74 [g]	.60±.59	.70±.66

Notes. VM Group = Video Modelling group; LM Group = Live Modelling group; M = Mean; SD = Standard Deviation; [a,b,c,d,e]Significant differences at $p < .001$; [f]Significant differences at $p < .05$; [g]Significant differences at $p < .01$.

.254), but there was no significant main effect of group ($F1,43 = .818$, $p = .371$, $\eta_p^2 = .019$) on Monitoring. Analyzing this interaction with respect to group effect, results showed a significant difference in Monitoring between pre- and post-intervention measurements for the participants in the experimental group ($F1,43 = 123.722$, $p < .001$, $\eta_p^2 = .742$). Also, there was a significant difference in Monitoring between pre- and post-intervention measurements for the participants in the control group ($F1,43 = 23.174$, $p < .001$, $\eta_p^2 = .350$). Mean scores showed that both groups improved their scores on Monitoring in the post-intervention measure (Table 4). Similarly, analyzing this interaction with respect to time effect, results revealed no significant difference in Monitoring between experimental and control groups at the pre-intervention measurement ($F1,43 = .135$, $p = .715$, $\eta_p^2 = .003$). Also, there was no significant difference in Monitoring between the experimental and control groups at the post-intervention measurement ($F1,43 = 3.636$, $p = .063$, $\eta_p^2 = .078$).

Evaluation indicator

Regarding evaluation indicator, results showed there was a significant main effect of time ($F1,43 = 149.005$, $p < .001$, $\eta_p^2 = .776$), and a significant time x group interaction ($F1,43 = 10.015$, $p = .003$, $\eta_p^2 = .189$), but there was no significant main effect of group ($F1,43 = 2.885$, $p = .097$, $\eta_p^2 = .063$) on Evaluation. Analyzing this interaction with respect to the group effect, results showed a significant difference in Evaluation between pre- and post-intervention measurements for the participants in the experimental group ($F1,43 = 132.909$, $p < .001$, $\eta_p^2 = .756$). Also, there was a significant difference in Evaluation between pre- and post-intervention measurements for the participants in the control group ($F1,43 = 36.791$, $p < .001$, $\eta_p^2 = .461$). Mean scores showed that both groups improved their scores in Evaluation in the post-intervention measure (Table IV). Similarly, analyzing this interaction with respect to time effect, results revealed no significant difference in Evaluation between experimental and control groups in the pre-intervention measurement ($F1,43 = .266$, $p = .608$, $\eta_p^2 =.006$). In contrast, there was a significant difference in Evaluation between the experimental and control groups in the post-intervention measurement ($F1,43 = 6.378$, $p = .015$, $\eta_p^2 = .129$). Mean scores showed that experimental group had higher scores in Evaluation in the post-intervention measurement compared to control group (Table IV).

Score Indicator

Regarding Score indicator, results showed a significant main effect of time ($F1,43 = 6.344$, $p = .016$, $\eta_p^2 = .129$), a non-significant main effect of group ($F1,43 = 1.106$, $p = .299$, $\eta_p^2 = .025$) and a non-significant time x group interaction ($F1,43 = 2.515$, $p = .120$, $\eta_p^2 = .055$) in Score. Paired sample t-test revealed significant differences in Score between pre- and post-intervention measurements for the experimental group ($t24 = -3.091$, $p = .005$, $d = .067$). More specifically, experimental group students reported higher values in Score at post-intervention compared to pre-intervention (Table IV). In contrast, paired sample t-test showed no significant differences in Score between the pre- and post-intervention measurements for the control group ($t19 = -.623$, $p = .541$).

Finally, means and standard deviations between experimental and control groups at the pre- and post-intervention measurements of all the examined variables are presented below in Table IV.

Discussion

The purpose of the present study was to investigate the influence of video and live modeling on students' self-regulation in physical education classes. The findings revealed that students from both groups developed their metacognitive skills. Regarding the first hypothesis, it is consistent with our expectations. The results showed that 8-year-old students use self-regulation strategies such as planning, monitoring, evaluation, and reflection in physical education classes.

Most of them monitored the performance outcomes and tried to find general strategies to improve performance. Some students were more precise, using specific focus strategies and monitoring not only the performance outcome but also the performance process. Our findings are in line with the findings from other studies which support the notion that children use strategies between the ages of seven and twelve (Weil et al., 2013) and that strategic knowledge begins at the age of eight and ten (Lehmann & Hasselhorn, 2010).

Regarding the second hypothesis, the results revealed that both groups developed their self-regulation abilities. The difference between the two groups was that the students in the VM group seemed to set outcome-specific goals and use specific technique strategies and general strategies, whereas the LM group used mostly general focus strategies. More specifically, regarding the planning indicator, before the intervention, many students from both groups were able to explain what was wanted from them to do. It showed that they were able to understand the concepts in the problem-solving process and that they tried to plan their execution. After the intervention, both groups seemed to set goals and choose strategies in order to achieve them. The students from the VM group seemed to set outcome-specific goals "to score a goal inside the box" and tried to apply more than two strategies to achieve their goals, such as specific technique strategies, i.e., "I tried to swing my kicking foot back for more strength", specific focus strategies, i.e., "to keep my eyes on the box and turn my body toward it," and general focus strategies, i.e., "to be focused". Students from the LM group seemed to use mostly general techniques, i.e., "I tried to kick with force" and focus-general goals, i.e., "I tried to concentrate".

Regarding the monitoring indicator, before the intervention, both groups of students explained that they mainly focused on performance outcomes. After the intervention, students from the VM group seemed to check the performance outcome and the performance process. They tried to justify their performances, i.e., "I think I was away from the ball when I was shooting". This situation was a positive monitoring indicator because in this phase student gather information that would be used to evaluate the effectiveness of their plan. Students from the LM group tried to monitor the progress of their performance, but they were not aware of their success or their errors, i.e., "I do not know what went wrong" maybe because they did not remember very well the specific elements of their teachers' demonstration so as to monitor their performance process.

During the evaluation/reflection phase and before the intervention, students from both groups tried to judged how well they performed against the performance of their model and following they tried to find strategies for optimizing their performance. After the intervention program, students from the VM group tried to find more than two alternatives when their executions were not effective, i.e., specific technique strategies ("I will try to take some steps back and kick with laces and force") and focus on a specific strategy ("I will look at the target or box"). Also, one student added, "I want to watch the video once again to see how he did it" (help-seeking strategy), and another said, "I will imagine myself doing this before shooting" (imagery). In the LM group, most students tried to find general technique strategies to improve a future learning attempt (i.e., "I will kick the ball with more force"). Some of them seemed not to remember very well their teacher's demonstration so as to successfully judge their performance process, and this may happen because background noise can affect students' focus while working in an open-space environment (Jafari et al., 2019).

According to the scoring indicator, both groups seemed to have better results after the intervention program but there was no significant difference between them. Students from the VM group had significantly better scores after the intervention, which may be due to the more accurate metacognitive strategies they used, such as imagery, help-seeking, and/or motivation, general and specific technique strategies. According to researchers, specific technique strategies seem to be more beneficial than general ones for sports performance (Zimmerman, 2006; Zimmerman & Kitsantas, 2005) and a combination of process and outcome strategies lead to effective perforrnances (Filby et al., 1999). On the other hand, the LM group students focused mainly on general criteria such as concentration and force. Our findings are in accordance with other research which found that observational learning can facilitate the learning of a skill but the increased knowledge does not lead always into higher performance. Students need more practice time to emulate the performance criteria (Goudas et al., 2017).

Findings on students' motivational processes, revealed that students from both groups appeared motivated as they tried to mimic the model and "be like him". Moreover, the VM group students appeared to pay more attention to the video presentation (cognitive process) and be more focused on the learning process so as to remember more about the kick presentation because they found it more interesting. This is in accordance with the notion that video technologies trigger students' interests and attention (Carmichael et al., 2018). Students understand and retain information better by capturing images of what they see during visual learning through technology, and such information is better organized in the learner's mind (Raiyn, 2016).

In our research, video modeling seemed to enhance students' attention possibly due to the repetition of the modeled skill, the captured images or students' interest in the images in motion (Ranker & Mills, 2014), and attention control strategies are very important because they help students to remain focused during the learning process. In contrast, most of the LM group students seemed not to remember very well the teacher's demonstration, but they remembered the keywords he mentioned.

Generally, video modeling could be used as an alternative technique to assist students in organizing their thinking and understanding how to perform effectively in order to create the basis for a healthy lifestyle throughout life. The current findings have practical importance for physical educators and students who can benefit from video modeling during motor skill acquisition. More research is required to examine the long-term effects of video modeling on students' self-regulation skills in kicking and other manipulative skills.

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