Effect of imagery training on football players

Baltic Journal of Health and Physical Activity

Volume 16 | Issue 4 Article 3

2024

Effect of imagery training on football players

Dagmara Budnik-Przybylska
University of Gdansk, Poland, dagmara.budnik-przybylska@ug.edu.pl

Franciszek Makurat
University of Gdansk, Poland, franciszek.makurat@ug.edu.pl

Jacek Przybylski
University of Gdansk, Poland, jacek.przybylski@ug.edu.pl

Tony Morris
Victoria University, Melbourne, Australia, Tony.Morris@vu.edu.au

Recommended Citation

Budnik-Przybylska D, Makurat F, Przybylski J, Morris T. Effect of imagery training on football players. Balt J Health Phys Act. 2024;16(4):Article3. DOI: 10.29359/BJHPA.16.4.03

Effect of imagery training on football players

Abstract

Introduction. There is a growing number of studies concerning imagery training in young athletes but on a much smaller scale than research in adults. The purpose of this study was to examine the influence of imagery training on children's soccer skills. (2) Materials and Methods: We conducted two studies. In the first study a sample of 35 subjects, aged between 10 and 14 years, was divided into an experimental condition (18 players) and a control condition (17 players). Each person completed one script from the Sports Imagery Ability Measure (SIAM) and from the Movement Imagery Ques-tionnaire-3 (MIQ-3) and took a performance test on pre-test and post-test. In the second study 40 players, aged from 11 to 14 years, were divided into the control group (12 players) and the experimental group (13 players). They filled out the same questionnaires, as well as the Sports Imagery Questionnaire for Children (SIQ-C). They took part in 6 and 8 weeks of imagery training, respectively. Participants in the control condition performed only the shooting pre-and post-tests. (3) Results: In the post-test, players in the imagery condition obtained better results in soccer skills and in SIQ-C, but not in imagery ability tests. (4) Conclusions: The results supported effectiveness of the imagery training, especially since the intervention was conducted during the COVID lockdown.

Keywords

imagery, imagery interventions, athletes, imagery ability, imagery use

Cover Page Footnote

We would acknowledge the master students: Adam Czyczel and Albert Kalinowski who gathered the data and conducted the study under the supervision of the first author of this paper.

Baltic Journal
of Health and Physical Activity
e-ISSN 2080-9999

Article

Effect of imagery training on football players

Dagmara BUDNIK-PRZYBYLSKA[1]*, Franciszek MAKURAT[2], Jacek PRZYBYLSKI[3], Tony MORRIS[4]

[1] University of Gdansk, Gdansk, Poland; ORCID 0000-0002-5943-4773
[2] University of Gdansk, Gdansk, Poland; ORCID 0000-0002-5869-3669
[3] University of Gdansk, Gdansk, Poland; ORCID 0000-0002-2980-2440
[4] Victoria University, Melbourne, Australia; ORCID 0000-0002-2883-7270

* Correspondence: Dr Dagmara Budnik-Przybylska; e-mail: dagmara.budnik-przybylska@ug.edu.pl

Abstract. Introduction. There is a growing number of studies concerning imagery training in young athletes but on a much smaller scale than research in adults. The purpose of this study was to examine the influence of imagery training on children's soccer skills. (2) Materials and Methods: We conducted two studies. In the first study a sample of 35 subjects, aged between 10 and 14 years, was divided into an experimental condition (18 players) and a control condition (17 players). Each person completed one script from the Sports Imagery Ability Measure (SIAM) and from the Movement Imagery Ques-tionnaire-3 (MIQ-3) and took a performance test on pre-test and post-test. In the second study 40 players, aged from 11 to 14 years, were divided into the control group (12 players) and the experimental group (13 players). They filled out the same questionnaires, as well as the Sports Imagery Questionnaire for Children (SIQ-C). They took part in 6 and 8 weeks of imagery training, respectively. Participants in the control condition performed only the shooting pre-and post-tests. (3) Results: In the post-test, players in the imagery condition obtained better results in soccer skills and in SIQ-C, but not in imagery ability tests. (4) Conclusions: The results supported effectiveness of the imagery training, especially since the intervention was con-ducted during the COVID lock-down.

Keywords: imagery, imagery interventions, athletes, imagery ability, imagery use.

Citation: Budnik-Przybylska D, Makurat F, Przybylski J, Morris T. Effect of imagery training on football players. Balt J Health Phys Act. 2024;16(4):Article3. DOI: 10.29359/BJHPA.16.4.03

Academic Editor: Dominika Wilczyńska

Received: August 2023
Accepted: September 2024
Published: December 2023

Publisher's Note: BJHPA stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

1. Introduction

Imagery as a part of mental training is very often used in sport development, but also in other fields. When used properly, it can help a person achieve great things. Measuring the effectiveness of imagery has long been of interest to scientists. There is a growing number of studies concerning imagery training among children and adolescents [1–5], but the number of studies is much smaller than research in adults.

By using imagery, an athlete is given a new training platform, which could be trained not only on the pitch or in the gym but also in the mind. The athlete can carry out mental simulations, that is, imagine scenarios of actions that have already happened or may happen. Such a training enables them to train their skills in a safe environment and pre-pare for competition. One of the important conditions is positive and controlled imagery with sport confidence [6–9] according to the notion "what you see is what you get" [10]. Imagery interventions are frequently used and well-established psychological tools to enhance performance in different aspects of life. Many studies have confirmed their positive effects in sports. A meta-analysis by Simonsmeier et al. [11] found that the overall effect of imagery interventions was medium in magnitude with d = 0.431 (95% CI [0.298, 0.563]) where imagery interventions significantly positively influenced motor performance, motivational outcomes, and affective outcomes. The best results were for imagery combined with physical practice.

One of the most popular imagery interventions is the PETTLEP model [12], which is highly effective in adults [13] and children [14]. The acronym stands for P – physical, E –environment, T – task, T – timing, E – emotion and P – Perspective. The "physical" is related to the physical nature of imagery which should be the same as in real performance. The "environment" in imagery should reflect the actual physical environment in which real performance takes place. The imagined "task" should be as close as possible to the real task. The "timing" refers to the same performance speed as the actual one (real-time). The "learning" element in imagery refers to the individual's current stage of learning and development with skill acquisition. The "emotion" refers to all emotions during imagery, such as real performance and coping with negative ones. The "perspective" feature indicates how imagery is viewed (internal vs external). Previous research shows that internal imagery more functionally evokes equivalent brain activity than external imagery [15]. On the other hand, some studies support the use of external imagery [16, 17]. To compromise these two perspectives, implementation of a combination of both perspectives [13] is suggested, which is easily done by more advanced athletes [18].

A study by Norouzi et al. [19] with 45 male adolescent novice players randomly assigned to external/internal PETTLEP imagery and a control condition revealed that skill performance increased more in the external and internal PETTLEP imagery condition compared to the control condition. The effect persisted in the external PETTLEP imagery condition. Research by Quinton et al. [14] tested the effects of a 5-week layered PETTLEP intervention (i.e., the gradual addition of PETTLEP elements) on children's movement imagery ability and soccer task performance. Pre- and post-test consisted of the Movement Imagery Questionnaire for Children and a motor task involving dribbling and passing the ball. The imagery intervention did not result in a significant improvement in the imagery ability or motor task performance; however, there was a significant positive correlation at post-test for the imagery group between age and ability to external visual and kinaesthetic imagery.

Imagery is very often combined with action observation (AOMI, combined action observation with motor imagery) not only in sport [20] but also in rehabilitation [21, 22]. Action observation involves the successful motor skill execution and evokes brain activity in the areas responsible for movement execution the same as imagery [23] and with imagery enhancing the final effect of the intervention [20]. Li-Wei et al. [1] in their study with young talented table tennis players aged 7 to 10 years revealed that children who were in an imagery training program experienced significantly greater improvements in stroke accuracy and technical quality than in comparison groups. This was a comprehensive intervention that also involved videos of perfect execution and relaxation training. In another study, researchers [24] found that for a simple motor task, such as throwing a ball from a distance at a specific target, children aged 8–9 years using imagery and children who learned through modelling using video recordings performed significantly better than children who learned only through physical training.

Most of the studies [11, 14] were field studies in which all situations could be controlled. However, what if physical practice was disturbed by the lockdown? On the other hand, imagery is treated as a technique that can be used without any additional devices or special room space. The COVID-19 pandemic has influenced people's lives worldwide, including athletes and coaches. People were closed in their homes, which limited their ability to engage with their normal activities, training and interactions with others. Pandemic situations had a negative impact on different spheres of athletes' lives such as mental health [25], difficulties in maintaining training conditions [26], and uncertainty concerning future competitions [27] not only for athletes but also for coaches [28]. Despite the negative effects of the pandemic situation, there were studies which showed that athletes performed better due to their daily routine [27].

Therefore, the aim of the study was to examine the influence of imagery training on children's soccer skills during pandemics. We conducted two studies: one during the lockdown and the other one during the pandemic situation, but with less restrictions.

Study one

We formulated the following research hypotheses:

1) Athletes performing the imagery-training program will significantly improve their ability to pass towards the goal and to shoot through a hula hoop compared to the control group.

2) There would be a greater increase in the imagery ability in the experimental group compared to the control group.

Study two

As in the first study, the aim was to see how adepts would respond to imagery training in soccer effectiveness and imagery ability. In this study, we also wanted to see how players would use imagery before and after the intervention.

We formulated almost similar research hypotheses as we did in study one. We also measured imagery use as the additional aspect of imagery intervention:

1) Athletes performing the imagery-training program will significantly improve in shooting at the goal.

2) There would be a greater increase in the use of imagery and ability in the experimental group compared to the control group.

2. Materials and methods

2.1. Participants

Study one

The survey involved 36 players from the Soccer Academy team who were randomly assigned to an experimental or a control group. Unfortunately, due to the coronavirus pandemic situation, 21 people were finally included in the analysis. There were 11 players in the experimental group and 10 in the control group, aged between 11 and 13 years.

Study two

In total, 40 players participated in the study. Due to the pandemic time, 25 people were included in the statistical analysis. The control group comprised 12 players, and the experimental group 13. The subjects' age ranged from 11 to 14 years.

2.2. Measurements

Study one

Two questionnaires and a specially designed test to measure the effectiveness of exercises were used to conduct the study. The first applied questionnaire was the SIAM (Sport Imagery Ability Measure [29]) questionnaire in a Polish adaptation [30]. It measures the ability to create images. In this study, the athletes referred to only one situation in sport. After imagining a scene in question, they rated their imagery on 12 scales.

The MIQ-3 (Movement Imagery Questionnaire-3 [31], in a Polish adaptation [32], was the second questionnaire used in the survey. It measures the ability to imagine four body movements through visual representation from an external and an internal perspective, as well as kinaesthetic representation. It consists of 12 exercises in which the person determines the level of difficulty of their performance on a 7-point scale. The Polish version of the MIQ-3 demonstrates good psychometric indices with good stability and internal consistency maintained over a 3-week period. The confirmatory factor analysis (CFA) with maximum likelihood confirmed the established three-factor model (RMSEA = .04) and a high index value of CFI - above .90 CFI (CFI = .93). Reliability indicators (composite reliability – CR) for individual factors present very high internal consistency (external visual imagery = .75, internal visual imagery = .79 and kinaesthetic imagery = .82).

Study two

In the second study, the following questionnaires were used:

Sports Imagery Questionnaire for Children (SIQ-C) [33] (in the Polish adaptation by D. Budnik-Przybylska and K. Karasiewicz [34] is derived from the version developed for adults (SIQ) and is used to assess the cognitive and motivational functions of imagery according to Pavio's model of imagery use [37]. The questionnaire measures how imagery is used by the subject. Responses are scored from 1 (not at all) to 5 (very often). The questionnaire consists of five scales: (1) specific cognitive imagery (CS) refers to the mental performance of specific skills, (2) general cognitive imagery (CG) includes mental rehearsals of plans, routines, or game strategies, (3) specific motivational imagery (MS) refers to goal-directed responses in a specific situation, (4) general arousal motivational imagery (MG-A) includes images related to competitive arousal and anxiety, and (5) general mastery motivational imagery (MG-M) refers to images of feeling confident. Confirmatory analysis of the Polish version indicates a satisfactory fit of the model to the data CFI = 0.877; TLI = 0.856; RMSEA = 0.075 (N = 575), and Cronbach's alpha statistics for each of the scales are as follows: CS (0.71), CG (0.71), MS (0.71), MG-A (0.67), MG-M (0.79) [34].

Movement Imagery Questionnaire (MIQ-3) in the Polish adaptation [32], which was described in the first study. The last tool used was the same single script as in the first study, with questions taken from the SIAM Sport Imagery Ability Measure [29] in the Polish adaptation [30]. The players referred to the circumstances of shooting the ball. After imagining this scene, they rated their imagery on 12 scales.

2.3. Procedure

Study one

The investigation followed the ethical principles of human experimentation defined in the Declaration of Helsinki, and the study was approved by the Research Ethics local Institutional Review Board of the University of Gdansk. Parents were asked to give their written consent to participate in the study. They were also informed about the aim of the study, confidentiality of all information, and anonymity of the study.

After obtaining permission to gather all the athletes in one place, they performed the test (pre-test) at the beginning of a sports camp during the January winter holidays before the lockdown.

At the very beginning, the children performed an efficacy test in a sports hall. The performance test consisted of a pass toward and a shot at the hula hoop. The goal was 90 cm wide, and the pass was made with the inside part of the foot from a distance of 10.5 meters. The hula hoop was attached to the goal, had a diameter of 100 cm, and the player shot from a distance of 7 meters. The children had 15 attempts to pass towards the goal and 15 attempts to hit the hoop. If a player hit the ball so that it did not touch the goalposts, he received 1 point. If the ball touched the post from the inside so that the ball fell into the goal, he received 0.75 points. If the player hit the post, he was awarded 0.5 points. The situation was similar for a shot at the hula hoop – 1 point for a clean hit, or 0.75 points if he hit the hula hoop but touched it and 0.5 points if he hit the hula hoop, but the ball did not fall into it. For a miss, the player received 0 points.

At a later stage, 21 players were given a SIAM questionnaire to complete. The content of the questionnaire was reduced to a single scene. First, the young athletes did a sample scene from the SIAM questionnaire (Fitness activity) to learn how to perform the task correctly and to stimulate their imagery. After that, the children closed their eyes while the coach read them the test instructions, in which they were asked to imagine the best way to pass the ball in the direction of the goal, which they had previously done during the effectiveness test: "Get a clear picture of what you are doing, where you are, and who you are with. Take notice of what you can see around you, the sounds you hear, and the feel

of any muscles moving. Do you get the sensation of any smells or tastes? Can you feel the equipment and surfaces you are using? Do you get an emotional feeling from this activity? Now you have 60s to create and experience an image of this scene. After 60 seconds, fill in all 12 scales. Don't spend too much time with each of them; the first reaction is the best." The subjects filled in the scales by writing a cross (exactly on the line) on a horizontal 10-centimetre scale. Sample questionnaire items are as follows: 3. How well did you feel the texture of objects within the image? 7. How well did you see the image? 11. How well could you control the image?

Another questionnaire used in the study was the MIQ-3 questionnaire. The group was then divided into an experimental and a control group. In the experimental group, a workshop was held to familiarize the players with imagery training, relaxation and creating a preparation routine. The players were specially prepared to create their picture in the best possible way. They were shown how often they learn through various physical activities, but also how they can learn in sports training using their imagery. To get the young students interested, they were shown a video of Robert Lewandowski, who promoted the imagery technique in cooperation with Nike. The children learned the ways and principles they should follow in order to make their imagery more effective. The models used were primarily those presented in the research theory, which were passed on to the children in a form accessible for their age.

The principles of imagery training say that imagery should: 1. be performed with eyes closed, 2. "replay" movement-related content at the same speed as in reality, 3. be multicoloured, bright and use as many senses as possible, 4. associate with and evoke positive emotions, 5. be controlled at all times, 6. be conducted after relaxation exercises. Relaxation was presented to them as a form of warm-up for the mind, during which a change of arousal is brought about to achieve a state of balance.

To observe the action, we used video recordings of a third-league player demonstrating an ideal performance, both in real-time and in slow motion, allowing the children to learn as much as possible from the displayed movement sequence. At the end of the workshop, the first exercise in relaxation and imagery training was carried out with the children. A specially prepared script contained audio recordings in which children, at the beginning, following the voice from the recording, focused on their breathing counting down (in their mind) from 10 to 1. They inhaled at even numbers, and at odd numbers they exhaled air from their lungs. Such a relaxation warm-up, where the children learned to control their breathing, was followed by recordings with imagery training. The imagery scripts contained a formula to stimulate the players to create a realistic and colourful image. The children were instructed to use their imagery from an internal perspective and, if necessary, sometimes also use an external perspective.

The imagery scripts:

1. "Keep your distance from the ball before shooting it. You feel confident and in control of the whole situation. Remember that the distance should always be the same. Before shooting, look at the target you want to direct the ball at. When you start your movement towards the ball, you are slightly leaning in your upper body. Now you move towards the ball, you take the last step putting your foot firmly on the ground, foot pointed towards the goal ("looking" at the goal). While shooting, concentrate on the movement from your hip. Your foot approaches the ball, imagine you are shooting the ball with the inside part of your foot. The foot is positioned rigidly. Focus on the sensations (feedback) coming from your body. When you shoot the ball, keep your eyes on the target (out the corner of your eye) at all times. As the ball is heading toward you, lead your leg steadily towards the goal, your foot is stiff in the joint until the end of the movement. You feel confident and in control of the whole situation."

2. "Keep your distance from the ball before shooting it. You feel confident and in control of the whole situation. Remember that the distance should always be the same. Before shooting, look at the target you want to direct the ball at. When you start your movement towards the ball, you are slightly leaning in your upper body. Now you move towards the ball, you take the last step putting your foot firmly on the ground. Start the movement by rotating your body. Start the movement from your abdomen, feel the tension in your abdominal muscles as you rotate your torso (body). Bend your leg and start straightening it towards the ball. You shoot with the inside of your foot underneath the ball, the foot is bent at an angle. As you swing, concentrate on the sensation coming from your body and the posture you have. Pay attention to the movement coming from the upper part of your body. Always keep your eyes on the target (out the corner of your eye). As the ball is heading in a given direction, lead your leg continuously toward the goal, your foot is stiff at the joint until the end of the movement. You feel confident and in control of the whole situation. Now take 20 shots at the hula hoop on your own with your lead leg in your mind".

At the very end of the workshop, there was time for questions from the children, and they received one .m4a file of the recordings along with the scripts. After the workshop, the players were asked to do relaxation and imagery training four times a week, always starting with the scripts. The coach gave the children diaries in which the players recorded their training sessions.

The training program lasted six weeks and was followed by a post-test. The players in the experimental and control group completed both questionnaires described earlier, after which they took the efficacy test again.

Study two

Similarly to the first study, during the initial stage of the study, parents were required to give written consent for their children to participate in the study. Once all consent was collected, all players gathered for the study (pre-test). The investigation adhered to the ethical principles for human experimentation as defined in the Declaration of Helsinki, and the study was approved by the local Institutional Review Board of the University of Gdansk

The study of the experimental group took place at the stadium 2 hours before the scheduled physical training. In the first part of the study, efficacy tests were performed. The players hit the ball at the target which was located in the goal. Before the efficacy tests, the coach explained in detail how to hit the ball correctly. The players shot from a distance of 10 meters away from the goal. The strike was made with the inside part of the foot into the designated target, which was the gap between the post and the cone. The distance between the post and the cone was 15 cm. Similarly to the first study, each player had 15 attempts.

In the case of shooting the goal, as well as knocking down the cone, the player received 1 point. What counted was an accurate shot at the goal. In case of missing the target or hitting the post, the player received 0 points. The tester had to pay attention to the height of the ball hit because in the situation of hitting the ball more than 1 meter high, the point was not scored. After all players had completed the efficacy test, they filled in the tests. The players were explained the general rules and guidelines on how exactly to per-form the tests. If a question was not understood, the researcher provided assistance. The initial test completed by the athletes was the SIQ-C questionnaire. Then players filled in MIQ-3 and, at the end the SIAM questionnaire. The coach read instructions to the test sub-jects to imagine a scene with their eyes closed. The players referred to the circumstances of shooting the ball. The next step was to prepare the subjects for mental training.

At first, the coach introduced the script (similar to the one in the first study) about shooting the ball with the inside part of the foot. The players had to understand the script and every detail of the element that made up the execution of the correct movement.

Mental script for shooting the ball:

"Keep the right distance before hitting the cone. You feel confident. Remember that the distance should always be the same. Before shooting, look at the target you want to direct the ball at. When you start your movement towards the ball, you are slightly leaning in your upper body. Now you move towards the ball, you take the last step putting your foot firmly on the ground. You start your movement by rotating your body. Lead the movement from your abdomen and feel the tension in your abdominal muscles as you rotate in your torso (body). Bend your leg and start straightening it towards the ball. You shoot with the inside of your foot underneath the ball, the foot is bent at the angle. While you are swinging, concentrate on the sensation coming from your body. Always keep your eyes on the target (out the corner of your eye). While the ball is heading in a given direction, lead your leg continuously toward the goal, your foot is stiff at the joint until the end of movement. The ball hits the target".

After the tests were completed, a workshop was conducted in the experimental group. Similarly to the first study, the main purpose of the training was to learn about the practical aspects of imagery training, relaxation, and creating a routine. Among others, the lesson explained the topics of learning through imagery and the importance of imagery in acting, rather than its effect. Young people learned techniques and principles that in-creased the effectiveness of imagery. All the information was conveyed simply and clearly so that the young people could easily assimilate it.

The players performed exemplary breathing relaxation, which was designed to lead them to change their arousal to achieve balance. After this relaxation, the group performed imagery of the shot in order to stimulate this process and perform the exercise correctly at home. The first 3 mental training sessions took place on the field. The children closed their eyes, and the coach read the instructions from the test in an appropriate tone, in which they were supposed to imagine the scene of hitting the ball, which took place in the efficacy tests.

After the mental lessons had been conducted, the soccer adepts were required to do mental training at home, 4 times a week for 2 months, and record their feelings in a diary. The diary was intended as a reminder to take training sessions and to observe the progress of the player's mental skills. The 8-weeks training program was followed by a post-test. The players filled in all the questionnaires described above and took the efficacy test. The testing procedure for the control group was the same with the difference that the group did not perform mental training. The tests of the control group took place at the football academy facility.

2.4. Statistical analysis

To verify the differences between the control and experimental groups, the Mann-Whitney U test was carried out. The Wilcoxon observation pair test was conducted to test the effectiveness of the intervention.

3. Results

Study one

The analysis of the data began by checking whether the control and experimental groups presented the same level of performance, imagery ability and use. We observed

statistically significant differences in shooting at the football goal (Z = -3.318, p = 0.001) and in creating images using the kinaesthetic perspective (Z = -2.194, $p < 0.05$), which suggested that the groups were not homogeneous in these aspects, with lower levels in the control group.

It was found that athletes implementing the imagery-training program would significantly increase their soccer skills, as presented in Table 1.

Table 1. Performance values of the results in the control and experimental group before and after the intervention – shooting at the football goal and shooting through a hula hoop

		Min	*Max*	*Mean*	*Median*	*Z*	*p*
Shooting at a football goal							
Control group	Pre-test	6	10.5	8.43	8.75	-0.297	0.766
	Post-test	6.5	11.75	8.4	8		
Experimental group	Pre-test	8.5	12.5	10.86	11	-1.378	0.168
	Post-test	8.5	14.5	11.86	11.75		
Shooting through a hula hoop							
Control group	Pre-test	4.25	11.75	7.63	7.63	-1.684	0.092
	Post-test	3.25	10.25	6.45	6.25		
Experimental group	Pre-test	3	8.25	5.89	5.75	-2.492	0.013
	Post-test	5	10.5	7.07	6.5		

Even though there were no statistically significant differences in shooting at a football goal in the experimental group after the intervention, a detailed inspection of the results showed an upward trend. In the experimental group, there was an increase in the mean and median value. However, in the control group there was a decrease in the mean value from 8.43 to 8.4 and a decrease in the median value from 8.75 to 8. The players from the experimental group improved their scores by increasing the mean and median value, but there were no such changes in the control group.

The ability to shoot through a hula hoop significantly improved after the intervention. The athletes achieved significantly higher scores in shooting skills after imagery training (Z = -2.492; p = 0.013). The research confirmed that the young athletes strengthened their shooting skills through imagery training. The control group decreased their results, which was almost significant (Z = -1.684, p = 0.092).

The second hypothesis assumed that the value of the imagery skill after the intervention would be higher in an experimental group than in a control group. The results turned out to be statistically insignificant. Detailed descriptive statistics are presented in Table 2.

Table 2. Results values for the imagery skill for the experimental group before and after the intervention

			Min	*Max*	*Mean*	*Median*
Internal perspective	Control group	Pre-test	4.75	6.5	5.78	5.75
		Post-test	4.25	7	5.5	5.5
	Experimental group	Pre-test	4.5	6.75	5.91	6.25
		Post-test	5.5	7	6.3	6.5
External perspective	Control group	Pre-test	4.5	7	5.98	6.13
		Post-test	4.25	6.5	5.47	5.25
	Experimental group	Pre-test	5	7	6.34	6.5
		Post-test	5.25	6.75	5.95	6
Kinaesthetic perspective	Control group	Pre-test	2.75	5.5	4.25	4
		Post-test	3.25	5.75	3.94	3.75
	Experimental group	Pre-test	3.25	6.75	5.23	5.25
		Post-test	3.5	6.5	5.09	5
SIAM script	Control group	Pre-test	3.47	8.38	5.67	5.5
		Post-test	3.49	8.87	5.46	4.98
	Experimental group	Pre-test	3.29	8.51	6.05	5.81
		Post-test	4.61	8.89	6.43	5.79

Study two

The analysis of the data began by checking whether the control and experimental groups presented the same level of performance, imagery ability, and use. Significant differences were observed between the control and experimental group in shooting ability ($Z = -2.83$, $p < 0.01$), the script from the SIAM questionnaire ($Z = -1.99$ $p = 0.02$), and in SIQ-C motivational general arousal ($Z = -2.75$, $p < 0.001$), where the control group achieved higher scores.

Next, we verified whether there were differences in passing toward the goal before and after training in both groups. There was a significant improvement in the experimental group, ($Z = -2.834$; $p = 0.002$), in which players obtained higher scores after training. In the control group, the change was insignificant ($Z = -0.257$; $p = 0.399$).

In the second step, hypothesis 2 was verified to check the effects of imagery training on the ability to use imagery. Descriptive statistics are presented in Table 3.

Significant changes were observed after training in the experimental group in the following SIQ-C subscales: specific cognitive imagery ($W = 15.5$; $p = 0.01$), general cognitive imagery ($W = 14$; $p = 0.04$), motivational imagery in the mastery perspective ($W = 8.5$; $p = 0.02$) and in the total score examined by the SIAM ($W = 7.5$; $p = 0.01$). In the control group, changes were insignificant. In MIQ-3, changes were insignificant in both groups.

Table 3. Comparison of the results of effectiveness and imagery before and after training – experimental group and control group

			N	*Min*	*Max*	*Mean*	*Median*
Internal perspective	Control group	Pre-test	12	4.5	7	5.77	6
		Post-test	12	5.3	7	5.98	6
	Experimental group	Pre-test	13	3.5	7	5.83	6.25
		Post-test	13	4	7	6.02	6.5
External perspective	Control group	Pre-test	12	4.3	6.75	5.54	5.5
		Post-test	12	5	7	5.88	5.75
	Experimental group	Pre-test	13	4.5	7	6.1	6.5
		Post-test	13	4	7	6.15	6.25
Kinaesthetic perspective	Control group	Pre-test	12	4.5	6.75	5.65	5.75
		Post-test	12	5	7	5.85	5.75
	Experimental group	Pre-test	13	4.3	7	5.58	5.25
		Post-test	13	3	6.5	5.56	5.75
SIAM script	Control group	Pre-test	12	4	8.33	5.75	5.38
		Post-test	12	4.17	8.25	6.2	6.55
	Experimental group	Pre-test	13	3.33	6.92	5.15	5.08
		Post-test	13	4.67	7.67	6.1	5.5
SIQ-C: specific cognitive imagery (CS)	Control group	Pre-test	12	2.5	4.75	3.73	3.75
		Post-test	12	1.5	5	3.67	3.88
	Experimental group	Pre-test	13	1	4.25	2.87	2.75
		Post-test	13	1.5	4.75	3.46	3.75
SIQ-C: general cognitive imagery (CG)	Control group	Pre-test	12	2.5	4.25	3.33	3.5
		Post-test	12	2.25	4.25	3.21	3.25
	Experimental group	Pre-test	13	1	4.5	2.94	3
		Post-test	13	1.25	4.75	3.48	3.75
SIQ-C: specific motivational imagery (MS)	Control group	Pre-test	12	2.5	4.5	3.17	3.13
		Post-test	12	2	4.5	3.46	3.5
	Experimental group	Pre-test	13	1.5	4.5	2.88	2.75
		Post-test	13	2.25	4.75	3.46	3.5
SIQ-C: general arousal motivational imagery (MG-A)	Control group	Pre-test	12	1.75	4.25	3.29	3.38
		Post-test	12	1	4.75	3.71	3.88
	Experimental group	Pre-test	13	1.25	4.75	3.25	3.5
		Post-test	13	1.5	4.5	3.35	3.5
SIQ-C: general mastery motivational imagery (MG-M)	Control group	Pre-test	12	3.2	5	3.92	3.9
		Post-test	12	2.8	4.8	3.9	4
	Experimental group	Pre-test	13	1.4	4.2	3.06	3
		Post-test	13	2.6	4.4	3.82	4

4. Discussion

Study one

The analysis of results made it possible to answer the research questions and hypotheses posed in the study. The first hypothesis concerned the performance of skills and the comparison of the control group with the experimental group. The second hypothesis concerned the increase in imagery ability in children who performed the 6-week program. As far as shooting at the football goal is concerned, the analysis conducted with the Wilcoxon test revealed that the results were not statistically significant. However, a deeper analysis of the experimental group's results showed an increase in the mean, median, and maximum value, while the minimum value did not decrease, remaining at the same value. This may explain the assumption that there was an upward trend in this group. The athletes in the experimental group achieved the increase in skills that was presented earlier, while the athletes in the control group had no such increase. The median value in the control group decreased.

The ability to shoot through a hula hoop in the experimental group increased significantly under the influence of imagery training. In the 6-week training program, the children improved their skills through a brief but systematic practice of shooting in their minds. It could be positive to introduce such training permanently in the academy and increase the impact of training on children's development. In the group that did not undergo imagery training, there was a decrease in the mean, minimum, maximum, and median values.

It is also worth mentioning that the results could have been clearer if more participants had taken part in the study. At the outset, there were 36 players; however, due to the coronavirus, only 21 remained until the very end of the study. A broader spectrum of results would have allowed for a more in-depth analysis. Additionally, the players took part in the efficacy test individually during the coronavirus on the school field when their football academy was closed. They did not have access to training facilities, so the improvement in performance during such a period may indicate the effectiveness of imagery training as particularly helpful in such a social situation.

Despite the upward trend and a significant improvement in soccer skills in the experimental group, no increase in imagery ability was observed, which was similar to the study by Quinton et al. [14]. Analysing the results, it can be seen that the children marked high values when completing the questionnaires for the first time they encountered the issue of imagery training in sport. At the very beginning, they marked answers intuitively, not really knowing what imagery and its applications are. Therefore, this phenomenon can be explained as a growing awareness of imagery creation among the athletes, as the impact of the imagery program itself brought promising and satisfactory results. The players achieved lower values in imagery ability, but the intervention helped them achieve higher scores in the efficacy tests. Perhaps, this was due to a growing awareness of imagery training among the children.

Study two

The results regarding the increase in accuracy in shooting confirmed the preconceived hypothesis – while players from the experimental group improved their accuracy, the participants from the control group shot goals at roughly the same rates 2 months after the first measurement. It is worth noting that those from the experimental group had visibly lower accuracy compared to those from the non-training group at the beginning of the study. The group participating in the experiment did not start from an equal level; rather, it can be said that those who exercised during those 2 months caught up with the non-training subjects, rather than gaining an advantage over them.

The results regarding the increases for the different types of imagery were inconclusive, but the overall result measured by the single SIAM script indicated that the players from the experimental group presented lower scores in the pre-test. Consequently, after the intervention, the experimental group obtained a higher increase in the imagery level;

therefore, the results in both groups were similar. Regarding MIQ-3, no significant changes were observed in either group, consistent with both the initial study and the findings of Quinton et al. [14]. Perhaps both interventions were too short for changes in MIQ-3, as the imagery ability.

In contrast to imagery ability, the SIQ-C results revealed that cognitive functions related to specific and general imagery and motivation improved in the experimental group compared to the control group. Those functions relate to imagining a specific movement, imagining a general strategy, and effectively coping with challenging situations. Our results are consistent with the study by Munroe-Chandler et al. [4], who found that young players reported using all functions of imagery for both cognitive and motivational purposes. Moreover, similarly to another study by the same researcher [5] that indicated that younger athletes (7–10 years) increased their use of CS imagery over time, the players in this study also presented higher CS imagery after the intervention.

Limitations and strengths

This research is not without limitations. The small sample size was the first limitation. However, one must stress that both studies were conducted in a pandemic reality. Secondly, in studies involving children, it is unclear whether they completed the questionnaires accurately, with full concentration and awareness. Unlike adult athletes, children and adolescents may not truly be aware of the benefits of imagery and, in turn, they may not take questionnaire completion seriously. Although the young players completed several imagery sessions with the coaches, the intervention may not have been sufficient in changing their imagery ability. On the other hand, imagery ability may also be considered as a trait which links to other individual differences, such as personality [35, 36]. There-fore, to observe any change there should be more time, longer training and/or a change in the personal stage of development. There is also a linkage between imagery ability and imagery use. Hall [37] indicated that the better the athlete is at imaging, the more effective the imagery will be, and also when athletes increase their use of imagery, their imagery ability will improve [38]. In the future, it is recommended to perform follow-up procedures over an extended period to determine if any changes in imagery ability emerge after the intervention.

These interventions lasted 6 and 8 weeks, respectively, with a suggestion of four sessions per week. This was similar to other studies on imagery training, which revealed that most interventions lasted approximately 4–6 weeks, three times per week for 15–20 minutes [39, 40]. Diaries were used to monitor and, at the same time, to motivate players to do the imagery training. The pandemic time was very hard for everybody and also for children. In study one, it was impossible to train on a pitch; however, it turned out that only mental training helped to increase soccer skills. Ruffault et al. [41] highlighted lower motivation scores during COVID-19 lockdown in athletes without a specific training program. Therefore, this was an additional advantage of imagery training to cope with the pandemic situation.

This research may guide further work on the impact of imagery training on the effectiveness in sports. A noteworthy trend was the increase in shooting accuracy in both experimental groups, in contrast to the control group. We also received information that to change imagery ability it would be worth conducting a follow-up study in the future. Also, a qualitative study of the players would be a valuable source of information, focusing on the process, the drive to improve performance, and the feelings of the subjects during the program.

More and more studies on mental training among children and adolescents are emerging, but this psychological research field should still be expanded. The research results presented here provide an additional point for further studies into the relationships and characteristics of imagery training in children and adolescent sport. The present pa-per has a lot of crucial practical implications. Educators and coaches should be aware of the role of imagery training and its advantages. They should combine traditional training techniques with imagery training to improve performance. It is also recommended to educate young athletes on the proper use of imagery and to convince them to use it in their daily routine.

5. Conclusions

This study confirmed that players from the experimental group improved their shooting accuracy compared to players from the control group. There were no changes in imagery ability; however, changes in imagery use were observed after the intervention. It is recommended to conduct a follow-up procedure to verify whether imagery ability would change in the long term after the intervention. This study has practical implications for coaches, players, and psychologists to combine traditional training techniques with imagery training and action observation.

References

1. Li-Wei Z, Qi-Wei M, Orlick T, Zitzelsberger L. The effect of mental-imagery training on performance enhancement with 7-10-year-old children. Sport Psychol. 1992;6(3):230–241. DOI: 10.1123/tsp.6.3.230
2. Munroe-Chandler KJ, Hall CR, Fishburne GJ, Shannon V. Using cognitive general imagery to improve soccer strategies. Eur J Sport Sci. 2005;5(1):41–49. DOI: 10.1080/17461390500076592
3. Munroe-Chandler KJ, Hall CR, Fishburne GOJ, Hall N. The content of imagery use in youth sport. Int J Sport Exerc Psychol. 2007;5(2):158–174. DOI: 10.1080/1612197x.2007.9671817
4. Munroe-Chandler KJ, Hall CR, Fishburne GJ, Strachan, L. Where, when, and why young athletes use imagery: An examination of developmental differences. Res Q Exerc Sport. 2007;78(2):103–116. DOI: 10.5641/193250307x13082490460580
5. Munroe-Chandler KJ, Hall CR, Fishburne GJ, Murphy L, Hall ND. Effects of a cognitive specific imagery intervention on the soccer skill performance of young athletes: Age group comparisons. Psychol Sport Exerc. 2012;13(3):324–331. DOI: 10.1016/j.psychsport.2011.12.006
6. Morris TE, Summers JE. Sport psychology: Theory, applications and issues; Australia: John Wiley & Sons Australia, 2004. DOI: 10.53841/bpssepr.2005.1.2.53
7. Morris T, Spittle M, Watt AP. Imagery in sport. Human Kinetics, 2005.
8. Orlick T. In pursuit of excellence. Human Kinetics, 2015.
9. Moritz SE, Hall CR, Martin KA, Vadocz E. What are confident athletes imaging?: An examination of image content. Sport Psychol. 1996;10(2):171–179. DOI: 10.1123/tsp.10.2.171
10. Martin KA, Moritz SE, Hall CR. Imagery use in sport: A literature review and applied model. Sport Psychol. 1999;13(3):245–268. DOI: 10.1123/tsp.13.3.245
11. Simonsmeier BA, Andronie M, Buecker S, Frank C. The effects of imagery interventions in sports: A meta-analysis. Int Rev Sport Exerc Psychol. 2021;14(1):186–207. DOI: 10.31234/osf.io/g5tp2
12. Holmes P S, Collins DJ. The PETTLEP approach to motor imagery: A functional equivalence model for sport psychologists. J Appl Sport Psychol. 2001;13(1):60–83. DOI: 10.1080/104132001753155958
13. Smith D, Wright C, Allsopp A, Westhead H. It's all in the mind: PETTLEP-based imagery and sports performance. J Appl Sport Psychol. 2007;19(1):80–92. DOI: 10.1080/10413200600944132
14. Quinton ML, Cumming J, Gray R, Geeson JR, Cooper A, Crowley H, Williams, SE. A PETTLEP imagery intervention with young athletes. J Imagery Res Sport Phys Act. 2014;9(1):47–59. Sport Psychol. 10.1515/jirspa-2014-0003
15. Ruby P, Decety J. Effect of subjective perspective taking during simulation of action: A PET investigation of agency. Nature Neurosci. 2001;4(5):546–550. DOI: 10.1038/87510
16. Hardy L, Callow N. Efficacy of external and internal visual imagery perspectives for the enhancement of performance on tasks in which form is important. J Sport Exerc Psychol. 1999;21(2):95–112. DOI: 10.1123/jsep.21.2.95
17. White A, Hardy L. Use of different imagery perspectives on the learning and performance of different motor skills. Br J Psychol. 1995;86(2):169–180. DOI: 10.1111/j.2044-8295.1995.tb02554.x
18. Smith D, Collins D, Hale B. Imagery perspectives and karate performance. J Sport Sci. 1998;16(1):103–104.
19. Norouzi E, Norouzi Seyed Hossini R, Afroozeh MS, Vaezmosavi M, Gerber M, Puehse U, Brand S. Examining the effectiveness of a PETTLEP imagery intervention on the football skill performance of Novice athletes. J Imagery Res Sport Phys Act. 2019;14(1):20180010. DOI: 10.1515/jirspa-2018-0010
20. Wright DJ, Frank C.; Bruton AM. Recommendations for combining action observation and motor imagery interventions in sport. J Sport Psychol Action. 2022;13(3):155–167. DOI: 10.1080/21520704.2021.1971810

21. Emerson JR, Binks JA, Scott MW, Kenny RP, Eaves DL. Combined action observation and motor imagery therapy: A novel method for post-stroke motor rehabilitation. AIMS Neurosci. 2018;5(4):236. DOI: 10.3934/neuroscience.2018.4.236
22. Scott MW, Wood G, Holmes PS, Williams J, Marshall B, Wright DJ. Combined action observation and motor imagery: An intervention to combat the neural and behavioural deficits associated with developmental coordination disorder. Neurosci Biobehav Rev. 2021;127:638–646. DOI: 10.1016/j.neubiorev.2021.05.015
23. Hardwick RM, Caspers S, Eickhoff SB, Swinnen SP. Neural correlates of action: Comparing meta-analyses of imagery, observation, and execution. Neurosci Biobehav Rev. 2018;94:31–44. DOI: 10.1016/j.neubiorev.2018.08.003
24. Doussoulin A, Rehbein L. Motor imagery as a tool for motor skill training in children. Motricidade. 2011;7(3):37–43. DOI: 10.6063/motricidade.7(3).131
25. Pons J, Ramis Y, Alcaraz S, Jordana A, Borrueco M, Torregrossa M. Where did all the sport go? Negative impact of COVID-19 lockdown on life-spheres and mental health of Spanish young athletes. Front Psychol. 2020;11:611872. DOI: 10.3389/fpsyg.2020.611872
26. Pillay L, van Rensburg DCCJ, van Rensburg AJ, Ramagole DA, Holtzhausen L, Dijkstra HP, Cronje T. Nowhere to hide: The significant impact of coronavirus disease 2019 (COVID-19) measures on elite and semi-elite South African athletes. J Sci Med Sport. 2020;23(7):670–679. DOI: 10.1016/j.jsams.2020.05.016
27. Samuel RD, Tenenbaum G, Galily Y. The 2020 coronavirus pandemic as a change-event in sport performers' careers: Conceptual and applied practice considerations. Front Psychol. 2020;11:567966. DOI: 10.3389/fpsyg.2020.567966
28. Costa S, De Gregorio E, Zurzolo L, Santi G, Ciofi EG, Di Gruttola F, Morgilli L, Montesano C, Cavallerio F, Bertollo, M. Athletes and coaches through the COVID-19 pandemic: A qualitative view of goal management. Int J Environ Res Publ Health. 2022;19(9):5085. DOI: 10.20944/preprints202201.0416.v1
29. Watt AP, Klep D, Morris T. Psychometric analysis of the sport imagery ability measure. J Phys Educ Sport. 2018;18(1):138–148. DOI: 10.7752/jpes.2018.01018
30. Budnik-Przybylska D, Karasiewicz K, Morris T, Watt A. Reliability, factor structure, and construct validity of the Polish version of the sport imagery ability measure. Curr Iss Personal Psychol. 2014;2(4):196–207.
31. Williams SE, Cumming J, Ntoumanis N, Nordin-Bates SM, Ramsey R, Hall C. Further validation and development of the movement imagery questionnaire. J Sport Exerc Psychol. 2012;34(5):621–646. DOI: 10.1123/jsep.34.5.621
32. Budnik-Przybylska D, Szczypińska M, Karasiewicz K. Reliability and validity of the Polish version of the Movement Imagery Questionnaire-3 (MIQ-3). Curr Iss Personal Psychol. 2016;4(4):253–267. DOI: 10.5114/cipp.2016.63218
33. Hall CR, Munroe-Chandler KJ, Fishburne G, Hall N. The sport imagery questionnaire for children (SIQ-C). Measur Phys Educ Exerc Sci. 2009;13(2):93–107. DOI: 10.1080/10913670902812713
34. Budnik-Przybylska D, Kuchta D. Is there a relation between temperamental predispositions and the use of imagery in young athletes? Develop Psychol. 2020;25(2):59–71. DOI: 10.4467/20843879PR.20.012.12267
35. Budnik-Przybylska D, Kaźmierczak M, Przybylski J, Bertollo M. Can personality factors and body esteem predict imagery ability in dancers? Sports. 2019;7(6):131. DOI: 10.3390/sports7060131
36. Budnik-Przybylska D, Kaźmierczak M, Karasiewicz K, Bertollo M. Spotlight on the link between imagery and empathy in sport. Sport Sci Health. 2021;17:243–252. DOI: 10.1007/s11332-020-00722-7
37. Hall CR, Mack DE, Paivio A, Hausenblas HA. Imagery use by athletes: development of the sport imagery ques-tionnaire. Int J Sport Psychol. 1998;29(1):73–89. DOI: 10.1037/t52953-000
38. Cumming J, Hall C. Deliberate imagery practice: The development of imagery skills in competitive athletes. J Sport Sci. 2002;20(2):137–145. DOI: 10.1080/026404102317200846
39. Schuster C, Hilfiker R, Amft O, Scheidhauer A, Andrews B, Butler J, Kischka U, Ettlin T. Best practice for motor imagery: A systematic literature review on motor imagery training elements in five different disciplines. BMC Med. 2011;9(1):1–35. DOI: 10.1186/1741-7015-9-75.
40. Paravlic AH, Slimani M, Tod D, Marusic U, Milanovic Z, Pisot R. Effects and dose-response relationships of motor imagery practice on strength development in healthy adult populations: A systematic review and meta-analysis. Sport Med. 2018;48:1165–1187. DOI: 10.1007/s40279-018-0874-8
41. Ruffault A, Bernier M, Fournier J, Hauw N. Anxiety and motivation to return to sport during the French COVID-19 lockdown. Front Psychol. 2020;11:610882. DOI: 10.3389/fpsyg.2020.610882

Author Contributions: Study Design, DB-P, FM, JP, and TM; Data Collection, DB-P, Statistical Analysis, DB-P, Data Interpretation, DB-P, FM, JP, and TM; Manuscript Preparation, DB-P, FM, JP, and TM; Literature Search, DB-P, JP. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The investigation followed the ethical principles of human experimentation defined in the Declaration of Helsinki, and the study was approved by the Research Ethics local Institutional Review Board of the University of Gdansk.

Informed Consent Statement: Parents were asked to give their written consent to participate in the study. They were also informed about the aim of the study, confidentiality of all information, and anonymity of the study.

Data Availability Statement: Data available from the corresponding author on request.

Conflicts of Interest: The authors declare no conflict of interest.

Acknowledgments: We would like to acknowledge the input of the master students: Adam Czyczel and Albert Kalinowski who gathered the data and conducted the study under the supervision of the first author of this paper.