

Enhancing free throw basketball shooting ability in female basketball players through imagery and concentration exercises

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Abstract

Problem statement. Free throws represent crucial scoring opportunities in basketball, occurring without opposition following technical violation by the opposing team. Despite their significance, many athletes, particularly female basketball players, struggle to capitalize on these moment. Besides mastering the technical aspects of shooting, the psychological state of the player plays a pivotal role. Successful free throw shooting can significantly impact a team's success. This study aimed to assess the impact of 16 sessions of imagery training and concentration exercises on the free throw shooting performance of women's basketball player age 15-18 years. **Methods.** Participants in the study were divided equally into two homogeneous groups based on pre-test results evaluated based on success rates with the ordinarily paired method. The form of the test instrument given is the *Steinhofer basketball test*. The implementation was carried out with two groups with one group being used as a control group, while the other group was treated in the form of imagery exercises and concentration exercises for 6 weeks with a frequency of meetings 3 times a week for 15-20 minutes each meeting. The imagery exercise provided is in the form of a video showing the implementation of free throw shooting techniques from professional athletes and Yantra training for concentration training. Furthermore, at the end of the week 6 meeting, the participants were again tested to obtain their post-test results. The results of the tests carried out were then processed using statistical data analysis techniques with Lilifors normality tests and t tests with a significant level of $\alpha = 0.05$. **Results.** This study investigated whether mental exercise and concentration were able to improve the ability of free throw shots or not. The results revealed that experimental and control group imagery exercises were equally influential. In the experimental group given imagery training increased by more than 6.00 effects compared to the control group that was not given imagery training by 1.75 on free throw shooting ability. **Conclusions.** Research can demonstrate that, when combined with the appropriate program, the use of visualization and focus training can enhance athletes' performance in finishing a development. By combining imagery training, concentration training, physical training, and consistent technique training, athletes can significantly improve the ability of female athletes to free throw basketball games.

Keywords: Free Throw, Woman, Training, Athletes

Introduction

In basketball games, basic shooting techniques must be mastered by each player well, and players are required to make shots to enter the ball as many as possible (Susanto et al., 2023). Adding scores in basketball games can be done by shooting well and of course it is necessary to prevent the opponents from doing the same. But there is a way to add scores without involving the opponent to do the same, namely the free throw shooting technique (Fazel et al., 2018). This technique is an opportunity given to a player to add scores unguarded from a position behind the *shooting free throw* and inside the semicircle (Irawan & Prastiwi, 2022). When shooting, the tough challenge is being able to fight the psychology of yourself (Lee et al., 2023). The role of the mental in this condition will play an important role apart from the ability of the technique itself. The psychic aspect deals with the structure and function of the psychic aspect (Alimuddin et al., 2023). Both characterological and cognitive that support the actualization of potential are seen in the achievements achieved (Komaini et al., 2024). In addition, the psychological aspect is very important in sports coaching and must be trained as well as physical exercise and technique (Gill et al., 2017). Sports psychology is a part of general psychology that helps produce athletes from beginners to champions or show their achievements (Handayani et al., 2023), and helping talented athletes to be able to actualize their talents in peak of achievement (Kiram et al., 2023).

In the game of basketball, mental exercise is essential to do free throws (Maher et al., 2020). When making free throws, players often feel pressured because they are in situations that require high accuracy and

concentration. This pressure can cause distracting anxiety, which can disrupt concentration and reduce the successes of free throws (Englert et al., 2015). Basketball often concentrates on physical training, but improving free throw skills also requires mental exercises such as focus and visualization (Milley & Ouellette, 2021). The consistency of players on the pitch can be affected if they do not strengthen this mental element (Alimuddin et al., 2024). Situational pressure, such as being under pressure while leading or falling behind in a match, can affect a player's free throw performance (Amaro et al., 2022). Deficiencies in stress and pressure management can lead to a decreased performance at crucial moments (Ritchie et al., 2017). Some players may have difficulty with free throws due to psychological factors such as low self-confidence or fear of failure. Deficiencies in overcoming this psychological aspect can lead to ongoing difficulties in free throw performance. Players who don't practice enough or don't get proper practice in free throws may have difficulty in improving their skills (Blumberg, 2014). Consistency and purposeful practice are necessary to improve the technique and confidence in free throws (Izzo et al., 2023).

Free throws in a basketball game require high concentration (Candra, 2020). Athletes with good mental health typically have better concentration abilities, which allow them to focus on technique and strategy during free throws (Ramadhan et al., 2024). The pressure to score points during free throws can trigger anxiety that can interfere with the technique and accuracy of the throw. Athletes who have good stress management skills tend to be calmer and able to control the pressure so that they can make free throws more effectively (Šimeček, 2023). Previous theories stated that male student-athletes were superior in constancy and were more able to control their emotions when competing (Hagan Jr, 2021). Therefore, it is very important to provide mental training to female athletes in the form of imagery exercises and concentration exercises. Concentration disorders are often related to mental health problems such as stress, anxiety, and depression. When a person has trouble in doing concentration, this can be a sign of a mental health problem that needs to be taken seriously.

Imagery training is an exercise in imagining a certain movement or situation whether it has been done or has never been done by involving all five senses consciously and intentionally with the aim of forming a creative imagination in one's mind (Kosteli et al., 2019). The benefit of imagery practice itself is to learn, repeat new movements or correct a wrong movement (Lindsay et al., 2023) or rudimentary and improve the ability of athletes to deal with various problems. Overcoming gaps in practice, imagery, and concentration is critical in the development of basketball player skills, especially in female athletes, which is very rarely noticed. Imagery helps players to visualize themselves performing certain movements and techniques perfectly. It helps strengthen brain-muscle connectivity, increases confidence, and reduces anxiety. To overcome gaps in imagery exercises, players need to be given proper training in using this technique (Rifki et al., 2023). This could involve special practice sessions where they focus on creating a clear and detailed mental picture of certain basketball moves. Similarly, concentration is the key to be consistent and do effective performance in the game (Chung et al., 2019). Players who can maintain their focus on the task at hand will have a greater likelihood of success. To overcome the gap in concentration, players need to be trained in concentration techniques such as meditation, visualization, or breathing exercises. They can also learn strategies to manage distractions and pressures that may arise during the game (Sinthania et al., 2023). Combining imagery with strong concentration can increase the effectiveness of exercise in sports (Lin et al., 2021). Players who can clearly imagine and focus their attention on their mental picture have a better chance of turning practice into solid performance on the field (Liza et al., 2024). Through a coordinated and consistent approach to imagery and concentration drills, basketball players can reduce gaps in their mental skills and improve their performance on the court, especially in basketball free throw takings (Milley, 2019).

Athletes will get better as the level of training techniques increases properly and correctly and considers the psychological factors possessed by a person. Each individual has different aspects of psychology, especially in male and female athletes (Schaal et al., 2011). Some previous researches have been done but more attention has been paid to male athletes. It is a big question that does the psychology of female athletes also need to be trained? The most important aspect that must be possessed by an athlete is how to be able to utilize the abilities possessed by being able to balance with the psychology he has. In addition, the next question is whether a female athlete is able to control her mental and concentration without special training? When doing concentration exercises, where does the focus go? Likewise, during imagery practice, what will be imagined in his mind. Because if they pay attention to their negative thoughts, then they will be able to take the wrong path, lose attention, and possibly perform poorly. When they focus on their technique, breathing, body, ball, or opponent, then they will have the opportunity to put on their best performance. When female basketball athletes master the physical techniques and mental training provided, then it is the mental strength that will bring them to their best performance (González-Devesa et al., 2023). This does not mean that the implementation of imagery exercises can completely replace real exercises or in physical demonstrations, but both must be given in one unit. Therefore, it is very important to conduct a study involving imagery training to see the impact that can be given so that later it can be a reference in conducting training, especially for basketball athletes.

Some problems that often arise in basketball are that the ability of athletes to develop their abilities is not in accordance with their expectations. Especially for athletes who are still a student that the concentration they have still tends to be disturbed by the thoughts of other activities (Rowan et al., 2023). This also happens to

female athletes in general. Concentration disorders can cause female athletes to make technical mistakes, poor decisions, and lose the ability to direct the ball on target (O'Kelly & Rossato, 2023). Continuous concentration disorders can reduce athletes' motivation and confidence. The inability to stay focused can make athletes feel frustrated and doubt their own abilities.

Several previous studies have discussed the importance of mental exercise in basketball games such as research conducted by (Cao et al., 2022) which discusses about the mental fatigue in basketball games. The study only described overall fatigue and performance in basketball without providing a solution to solve the mental problem. The most recent research related to basketball training reveals a dynamic balance exercise in throwing a basketball (Boonsom & Bungmark, 2024). The practice given only leads to technical practice without taking into account the psychological contribution in the game. Some references have also been obtained in studies related to mental training in basketball games, namely the effects of imaging and concentration exercises related to free throw performance in basketball games (Uludağ et al., 2021). But the effect of the exercise can only be seen from a long span of time. Actually, research related to mental training in basketball games is quite a lot (Ramadhan et al., 2024), (Dereceli, 2019), (Candra, 2020), (Zhang, 2022). Of all the research results only focused on one of the mental abilities of male basketball athletes, and no one has looked at the effects of mental training for female athletes.

To answer the problems described earlier, the approach used in this research is by conducting an experiment which gives exercises in the form of imagery exercises and concentration exercises to see the effects that can be produced from the exercises. By providing psychological exercises in the form of concentration and imagery exercises applied to female athletes, it is expected to have a positive impact. Sports psychology is strongly reliant on imagery and focus. In this study, we tested the effects of imagery and concentration training on female basketball players during a 6-week training period that involved 16 exercises which are performed three times a week. Another goal, in addition to looking at spatial orientation and free throw shooting techniques, was to prove that imagery exercises with visualization and concentration exercises would be considered successful if there was a change in free throw ability at the end of the exercise.

Materials and Methods

Study Design and Participants

The selection of participants in this study is done by conducting trials on high-level women's basketball players because their techniques have already developed significantly and there is unlikely to be an improvement in performance simply because of a change in technique. Of the four best schools, 16 female players with an average age of 15 to 18 enrolled. All participants sign a written information consent document. Furthermore, participants in the study were divided equally into two homogeneous groups based on pre-test results which were evaluated based on the success rate with the ordinaly paired method. The study was conducted with two groups, namely the treatment group of concentration exercises and imagery exercises (n:8) and the control group who performed exercises as usual without additional treatment (n:8). This study has been approved by local ethics boards in Indonesia. The following research design was conducted in the study:

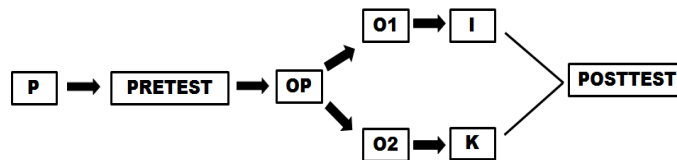


Figure 1. Research design

Procedures and Instruments

The form of the test instrument given is the *Steinhofer basketball test* (Abou el Ella & Fahmy, 2017) with a validity level of 0.86 and reliability of 0.92. The implementation was carried out with two groups with one group being used as a control group, while another group was treated in the form of imagery exercises and concentration exercises for 6 weeks with a frequency of meetings 3 times a week for 15-20 minutes for each meeting. The imagery exercise provided is in the form of a video showing the implementation of free throw shooting techniques from professional athletes and Yantra training for concentration training. Furthermore, at the end of the week 6 meeting, the participants were again tested to obtain their post-test results.

Steinhofer Basketball Test

The test taker stood in the free throw area, when he heard the "yes" signal from the data collection officer, the participant shot at the basketball basket. Participants must not cross the line before the ball is out of hand. Participants are first given the opportunity to have test throw 1 time and then make 15 free throw test shots. The group is established uniformly as a consequence of the testing. Groups were formed based on the success rate of free throws, which was used to rank them for the control group (1-4-5-8-9-12-13-16) and for the concentration and imagery groups (2-3-6-7-10-11-14-15). All groups conduct their regular training, while the study was not conducted with a control group.

Imagery Training Program

The imagery treatment given is in the form of a video showing the implementation of free throw shooting techniques by a professional athlete. Researchers also direct athletes to put the body in the most comfortable position possible. Direct the athlete's attention exclusively to the currently playing video about the movement of free throw shooting technique. The video provides an explanation of the procedures for doing free throw shooting techniques effectively and accurately, with the aim of producing optimal shots. The step-by-step application of the free throw shooting technique is explained in detail in the video using slow motion, so that athletes can understand each movement more thoroughly. Occasionally, athletes are also invited to visualize these movements to improve their memory skills. After undergoing movement training sessions from the coach and assisted by visualization instructed by the coach, the athletes began to carry out the free throw shooting technique directly and real. Keep the memory in their mind and repeat the movement repeatedly, focusing their mind on the goal they want to achieve.

Yantra Program Training

Yantra is a white, 5-by-5-cm square concentration exercise set against a 30-by-30-cm black background. Participants must sit approximately one meter away from the Yantra, which is positioned at eye level in the centre of a white wall. He closed his eyes and imagined the black screen in his mind after only looking at the black background for a while. After that, the person slowly opened his eyes and tried to look at the white box in the middle. When he saw the color formation around the gray white box, he gradually switched to the white wall. One would see the opposite image to Yantra here; more precisely, the black box is in the middle of the white background. The person has the ability to restore images, even if they are lost. Participants were advised to read the script and then practice the Yantra for 15 minutes three times a week over a period of 16 meetings.

Data Analysis

The results of the tests that have been carried out are then processed using statistical data analysis techniques using descriptive and inferential with the use of the t test formula with a significant level of $\alpha = 0.05$. Before the t-test analysis is used, a data normality test is first carried out with Lilifors and continued with a homogeneity test.

Results

Pre-test and Post-test Data of the Treatment Group

The effect of imagery training on free throw shooting ability, from the results of the pre-test free throw shooting ability obtained the lowest value of 2, the highest value of 7, the average was 3.75, and the standard deviation was 1.91 while the post-test results of free throw shooting ability gets the lowest value is 7, the highest value is 12, the average is 9.75, and the standard deviation is 2.12. For more details can be seen in the following table:

Table 1. Frequency Distribution of Pre-Test and Post-Test Data Shooting Free Throw Treatment Group

Interval Class	Fa		Fr		Category
	Pre- Test	Post-Test	Pre- Test	Post-Test	
15	0	0	0	0	Very good
11-14	0	4	0	50,00	Good
7-10	1	4	12,50	50,00	Keep
4-6	3	0	37,50	0	Less
1-3	4	0	50,00	0	Less than once
Sum	8	8	100	100	

The followings are also illustrated the results of pre-test and post-test data in the treatment group with a histogram so that the differences that occur clearly in the results of the study are also illustrated:

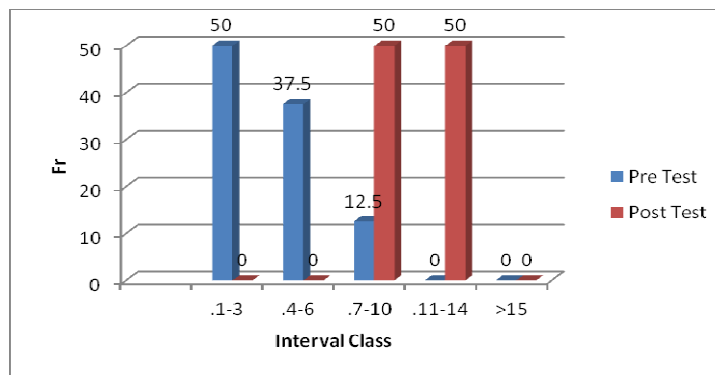


Figure 3. Histogram of Pre-Test and Post-Test Free Throw Shooting Ability

Pre-Test and Post-Test Free Throw Shooting Ability of Control Group

The effect without imagery training on free throw shooting ability, from the results of the pre-test free throw shooting ability obtained the lowest value of 1, the highest value of 9, the average was 3.75, and the standard deviation was 2.71 while the post-test results of free throw shooting ability gets the lowest value is 3, the highest value is 10, the average is 5.50, and the standard deviation is 2.67. For more details can be seen in the following table:

Table 2. Frequency Distribution of Pre-Test and Post-Test Data Free Throw Shooting Capability of Control Group

Interval Class	Fa		Fr		Category
	Pre-Test	Post-Test	Pre-Test	Post-Test	
15	0	0	0	0	Very good
11-14	0	0	0	0	Good
7-10	1	2	12,50	25,00	Keep
4-6	3	4	37,50	50,00	Less
1-3	4	2	50,00	25,00	Less than once
Sum	8	8	100	100	

The followings are also illustrated the results of pre-test and post-test data in the control group with a histogram so that it can be clearly seen the differences that occur in the results of the study:

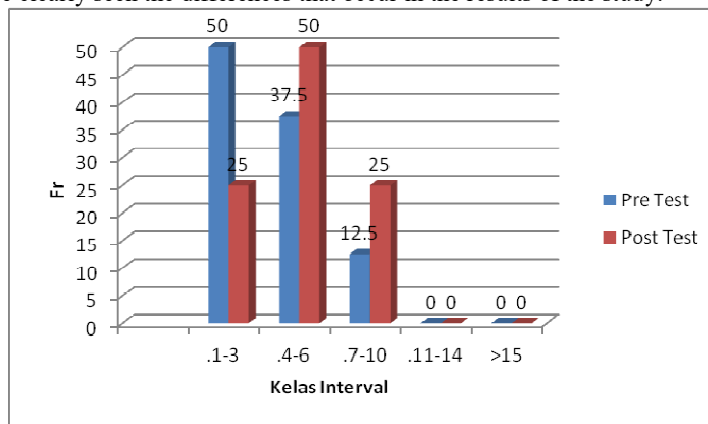


Figure 4. Histogram of Pre-Test and Post-Test Free Throw Shooting Capability of Control Group

Test Results Analysis Prerequisites

a. Normality Test

In the table below, it can be seen that the result of $L_{calculate}$ is smaller than L_{table} , so it can be concluded that the data is normally distributed.

Table 3. Normality Test Results Summary

Variable	Group	$L_{calculate}$	L_{table}	Information
Experiment	Pre test	0,1962	0,285	Normal
	Post test	0,1689		
Control	Pre test	0,2141	0,285	Normal
	Post test	0,2140		

b. Homogeneity Test

It is evident from the results of the homogeneity test analysis of each variable that the data is homogeneous because the result of F_h is less than the result of F_t . The table below displays the following information:

Table 4. Homogeneity Test

Variable	F_h	F_t	Information
Experimental Group	1,24	3,79	Homogeneous
Control Group	1,03	3,79	Homogeneous

c. Hypothesis Testing in the Treatment Group

After the analysis requirements are tested and it turns out that all variable data meet the requirements for hypothesis testing. The statistical test used is a t-test with a significant level of 0.05. The results obtained that there was an effect of imagery and concentration training on free throw shooting ability with an average score of 3.75 and a standard deviation of 1.91 in the pre-test, and after being treated 16 times the average score of 9.75 and standard deviation of 2.12 in the post test. From the table data, it can be said that there is an effect of imagery training on the ability to shoot free throw ($t_{count} = 12.96 > t_{table} = 1.895$), thus the proposed hypothesis is accepted.

Table 5. Results of Hypothesis Testing of the Experimental Group

Free throw	Mean	SD	T _{count}	t _{table}	Test Results	Information
Pre test	3,75	1,91	12,96	1,895	Significant	Has been accepted
Post test	9,75	2,12				

d. Hypothesis Testing in the Control Group

After the analysis requirements are tested and it turns out that all variable data meet the requirements for hypothesis testing. The statistical test used is a t-test with a significant level of 0.05. The results obtained that there was a significant effect without imagery and concentration practice on free throw shooting ability with an average score of 3.75 and standard deviation of 2.71 in the pre-test, and without imagery practice and concentration of an average score of 5.50 and a standard deviation of 2.67 in the post test. The data in the table can be said that there is a significant small effect without imagery practice on the free throw shooting ability ($t_{count} = 5.58 > t_{table} = 1.895$).

Table 6. Control Group Hypothesis Testing Results

Free throw	Mean	SD	T _{count}	t _{table}	Test Results	Information
Pre test	3,75	2,71	5,58	1,895	Significant	Has been accepted
Post test	2,67	2,67				

Discussion

The study's findings demonstrated that there was a noteworthy distinction between the experimental and control groups. Based on the increase, the experimental group was found to have an increase in free throw shooting ability of 6.00. This value is greater than the increase in the control group's free throw shooting ability of only 1.75. Which means that by doing exercises as usual with certain techniques can improve the ability of free throws. But with the addition of mental exercises such as imagery training, it will be better to increase the free throw ability of female basketball athletes.

According to the researchers and in accordance with the data and reality in the field that the experimental group is more influential than the control group on the ability to shoot free throw, where the experimental group uses a regular imagery exercise program will ultimately have a significant influence on learners. Meanwhile the control group only practiced free throw without adding imagery exercises, the control group could imitate imagery exercises through experimental group students who received treatment.

Imagery exercise can be a very useful addition in improving the performance of athletes (Alicea et al., 2024). Included in the sport of basketball in this case at the time of free throw which requires concentration and good mentality. When doing free throws with good imagery, athletes are able to imagine in detail the movements or techniques that have been learned and desired in their minds which usually cover all aspects, such as body position to point of view. With imagery exercises that have been done can help athletes visualize the correct technique, there is an increase in focus and concentration, and able to manage stress that can occur (Lee et al., 2023, Hut et al., 2023). But it's important to remember that imagery training is not a substitute for actual technique practice, but as an additional form of exercise. Imagery can help strengthen the connection between the brain and muscles that can improve mental performance in exercise (Iacono et al., 2021). Physical exercise and consistent technique practice remain the main keys to improve free throw ability. The ideal way is by combining imagery exercises with hands-on technique exercises for optimal results.

In a good experiment, the roles of the experimental group and the control group are designed in such a way that the variables that might affect the outcome can be carefully controlled (Campbell & Stanley, 2015). The goal of the control group is to provide appropriate comparisons with the experimental group so that the effects of the intervention or treatment can be isolated and identified (Rogers & Revesz, 2019). From the results of the research that has been done, the control group is really considered and balanced with the treatment group so that it can be clearly seen the differences that occur after giving treatment to other groups. From these results, the control group and the treatment group both had improved abilities after intensive exercise. The difference in the different improvements was that the treated group had a much better improvement than the control group. This means that the training given is very good, but with the addition of imagery training and concentration training as a solution to overcome mental problems that occur in athletes, especially female athletes are much better to improve.

In the context of free throw shooting ability, if the experimental design has taken into account relevant variables and controlled for external factors that might affect the results such as training technique, level of physical fitness, and psychological factors (Amra et al., 2023), then the results from the experimental group and the control group can provide useful information. However, directly saying that the experimental group was more influential than the control group is not always true without looking at the experimental design and statistical analysis used to evaluate the results. From this explanation, it can be proven by the results of research that has been carried out that the results of statistical analysis have shown a significant difference between the pre-test and post-test results between the two groups even though together they provide improvement. The findings in the research that have been carried out are in line with the results of the study and some previous findings.

Conclusions

Imagery exercises help strengthen the brain and muscle connections necessary to perform movements correctly, manage stress, and boost confidence. Imagery exercises have a significant impact on improving the mental management of a female student-athlete. In addition to imagery exercises, the addition of concentration exercises provided has been able to help athletes improve their focus so that they can reduce technical errors and improve the consistency of their performance, especially in the implementation of free throws in women's basketball athletes. The combination of the two exercises has a significant effect on the athlete's ability to focus more and be able to maintain the performance that he has had from technical training. This means that technical exercises are very necessary to be combined with psychological exercises in the form of imagery exercises and concentration exercises. Although imagery exercises and concentration exercises provide great benefits, it is important to know that they are only complementary exercises for consistent physical exercise and technique training. By combining image training, concentration training, physical training, and consistent technique training, athletes can significantly improve their ability to make free throws in basketball.

Conflicts of interest

The authors report that there is no potential conflict of interest.

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