The aim of the paper was to propose a didactic aid to practice and develop bank shots in basketball. Four basketball players (three men and one 13-years old woman) were shooting bank shots from six distances (1, 2, 3, 4, 5 and 6 m) and at four angles (90°, 75°, 45° and 25°) respective to the board. An experimenter positioned behind the transparent backboard recorded the points of impact of 15 successful shots (without touching the rim) for each of the above distances, angles and shooters. With perpendicular shots at the backboard, we identified only negligible dislocation of the set of impact points. With angled shots, the set of impact points tended to move towards the side edge of the board and upwards depending on the angle of the shooter’s position to the board and his/her distance. The farther the shooter from the basket and the lower the angle at which the shooter was shooting, the closer the impact point was towards the upper corner of the board.

We proposed a very simple and economically viable didactic aid to practice bank shots, consisting of a circle and two slanted ellipses placed on the backboard.

**Keywords:** basketball, didactic aid, bank shots, backboard

### Introduction

Basketball shooting is an indispensable means enroute to victory of any given team. It is not possible to score a basket with any other activity in the game. This is the reason why it has become the focus of more than a hundred years long research of basketball professionals to improve its efficiency and success rate. The situation would be a lot simpler if there was only one single type of shooting. We believe that there are innumerable
Didactic Aid for Bank Shots in Basketball

ways to shoot in basketball. As the time goes by, some of the types of shooting ceased to exist in line with the development tendencies, e.g. two-hand underhand free throw shot and new means of shooting came to existence, e.g. dunking.

From the viewpoint of the flight of the ball, after releasing it from the shooter’s hands, there are only two possible ways for the shooter to hit the basket – either directly or with a rebound of the ball from the bank. In our treatise, we will deal with a proposal to implement a new didactic aid to help develop and practice bank shots.

Basketball history bears witness to the fact that, with the exception of individual players, teams and events, the curve of improvement in basketball shooting stagnates. Even if we admitted that the success rate is on a rise, we could be able to trace its tiny improvements only by decades (Manley, 1989). It seems as if the training of basketball shooting and pushing the envelope of players’ capabilities reached a certain ceiling level and the training activities were no longer focused on improvements in shooting for the purposes of matches and games.

Fig. 1. Shooting percentage of field shooting and free-throw shooting in NBA from 1950 to 1990 (Manley 1989)
This is the reason why we deem it important to research and develop new material didactic aids which could improve the success rate of basketball shooting in future.

In the past, there were a great number of authors who analyzed the ways to improve the success rate of shooting and discussed the reasons why it is sometimes more successful, other times not. We will herein concentrate only on the works implementing didactic aids with the aim to improve the efficiency and success rate of basketball shooting.

Mortimer (1951), with the aim to improve the trajectory the ball describes as it flies in a basketball shot, suggests using small stripes hanging on a horizontally attached bar, considering the fact that the shooter must shoot the ball in a way that, as it flies by towards the rim, it must stroke the stripes. She also specifies varying heights of the bar placement with respect to the distance from the basket. (Figure 2)

![Figure 2](image)

**Fig. 2.** Improving the ball arc. The ball is released from behind the Line 1; it touches the ends of stripes and falls on Line 2 (Mortimer 1951)

Bunn (1963) considered the placement of reference points on the backboard, serving as guidelines for shooting, to be an important means to improve the efficiency of the shooting process. After a four-week-long shooting training, the experimental group improved its proficiency in shooting by 6.8% in contrast with the control group.
Farley (1967) used a mechanical device fastened to the basketball construction to improve one-hand set shot of young basketball players. He found out that the players in the experimental group who were using the mechanical device achieved better shooting results than the players in the control group. The players in the experimental group also improved their release angle.

Semikop-Barkov (1976) have researched the usage of an oval metal extension fastened to the standard rim. They recommend its implementation in practicing free throws, direct shots from the field and rebound shots. In contrast with the control group, the implementation of such a tool caused increased efficiency in shooting of 12-years-old basketball players in the experimental group by 6.3-9.1%.

Based on their research focused on 9-12-years-old players, Chase – Ewing – Lirgg – George (1994) propose to decrease the size and weight of the basketball and the height of the basket. The option to use a lower rim and a smaller ball in practicing basketball shots is most appropriate for 9-10 years-old boys and (especially) girls. This experiment increased confidence in the upcoming shots (especially with boys).

Murray (1981) researched particular points of impact/carom spots of a ball rebounding from the backboard. He states that each shot at the backboard has its individual point of impact/carom spot depending on the distance between the shooter and the board and what angle the shooter is to the backboard. He suggests placing visible continuous horizontal lines and crosses – cross marks, assisting the players to capture the point of impact with shots on the board.

Fig. 3. Sample of points (1) and line (2) of ball rebound (Murray 1981)
Blurton (1968), Ecklund (1975), Sharpe (1975), Stinar (1982), Skleryk-Bedingfield (1985), Sater-Messier-Keller-McNulty (1989) have introduced didactic aids to improve the success rate of shooting. While practicing shooting at the rim, they were changing its size and height and the size and weight of the ball. Sharpe (1975) rightly points out that while using a smaller rim in practicing shooting at the backboard, there is a need to count with an identical distance of the rim center from the backboard, much like with a standard rim.

The results proposed by Mathes-Flatten (1982) show that synthetic balls with plastic surface possess rebound characteristics different from standard leather basketballs. Leather balls rebound farther than the synthetic ones.

**Rebound from a level surface**

Hay (1993) and Brancazio (1981) were studying ball rebounds from a level surface. The analyzed rebounds were not identical with the rebounds of a basketball from the backboard, which is perpendicular to the floor. Brancazio (1981) described the differences of a ball rebounding from a level surface with horizontal spin, forward spin, backspin and no spin.

![Diagram](image-url)  
(a) no initial spin  
(b) initial forward spin  
(c) initial backspin

Fig. 4. Basketball rebounds from a level surface (a) with no initial spin, (b) initial forward spin and (c) initial backspin (Brancazio 1981)
The main difference between the ball rebounding from a level surface and a backboard is in the spatial distribution of the player and the board, in the spherical shape of the ball and in the flight curve characteristics of a shot at the backboard. With direct rim shots, the rotation axis is parallel to the surface but the point of contact on the ball (when it touches the board) is not identical in terms of its characteristics with the point of contact of the ball rebounding from a level surface. We may conclude that the point of contact on a ball hitting the backboard is towards the bottom of the ball, whereas with the ball rebounding from the ground, it is at the very bottom of the ball.

Another peculiarity of bank shots is established by the fact that with bank shots from under the basket, the rotation axis is not horizontal but slanted.

In comparison with rebounds from a level surface, the rotation speed of the ball combined with the rotation angles in a bank shot result in a lot more rebound angles. Works dealing with rebounds of a basketball from a level surface were not accessible to the author of the study at the time of its elaboration.

**Mechanical Devices**

A significant resource in the implementation of didactical aids in practicing basketball shooting in general and shooting at the board is represented by mechanical devices. Their implementation would enable us to modify the angle of the board (Lukašenok-Nedel’skij 1980), define the release angle (Juhl 1986), to perform a technically correct motion in the elbow and arm joint while shooting (Bishop 1982), (Furr 1985), to train the entry angle into the rim (Lamb 1984), to apply the alterations in rim height (Nye 1986), (Kluczny 1987) and to define a correct grip of the ball in shooting (Okerlin 1985), (Brown 1987).

**Aim**

The aim of this work is to propose a didactic aid to practice and improve the success rate of bank shots in basketball.

**Tasks**

To meet the aim of our work, it was necessary to:

- propose and perform an experiment in order to determine the
optimum rebound angles of a basketball from the backboard in bank shots from various distances and angles,
• propose a didactic aid contributing to the improvement of bank shots training in basketball.

**Methodology**

*Description of Probands*
Experimental shooting was performed by three adult men currently playing in the II. league, The Bratislava City Tournament, and by a women player currently playing in Junior Regional Collegiate League. Their characteristics are provided in Table 1.

<table>
<thead>
<tr>
<th>No.</th>
<th>Shooter</th>
<th>Age (years)</th>
<th>Height (m)</th>
<th>Reach (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>JP</td>
<td>27</td>
<td>1,71</td>
<td>2,35</td>
</tr>
<tr>
<td>2.</td>
<td>JK</td>
<td>23</td>
<td>1,78</td>
<td>2,43</td>
</tr>
<tr>
<td>3.</td>
<td>JH</td>
<td>26</td>
<td>1,86</td>
<td>2,50</td>
</tr>
<tr>
<td>4.</td>
<td>HB</td>
<td>13</td>
<td>1,65</td>
<td>2,18</td>
</tr>
</tbody>
</table>

*Description of Experiment*
The shooters were shooting one-hand set bank-shots from a spot. The shooters were shooting set shots because the intention was to eliminate the negative influence of potentially varying release heights of the ball while shooting.

They were shooting sequentially from the dedicated spots depicted in Figure 5 (see next page). The distance of the spots from the basket was 2, 3, 4, 5 and 6 meters.

The impact angles at the backboard were 90°, 75°, 45° and 25°.

Each spot was shot from until the shooter reached 15 successful shots without hitting the rim – clean shots.

The shooting was performed using a basketball support with a transparent board and a grid of 10 cm wide squares, which was, however, not visible to the shooter. The experimenter was positioned behind the board. His task was to draw the points of impact of the successful shots.
(meeting the “clean shot” condition) into a backboard sketch downsized to 1/4 of the original size.

![Figure 5. Shooting Spots](image)

**Results**

With the perpendicular direction respective to the board (90°), the change in shooting distance did not cause the displacement of the sets of impact points with Shooter 1. This above all goes for the distances A₂ through A₆. A little raised position of the set of impact points for the distance A₁ (1 m) was probably caused by the fact that, shooting from a closer distance, the shooter must shoot above the rim, which hinders the shot to a certain extent and forces him/her to shoot with a greater arc. Other experimental shooters shared identical tendencies.
Fig. 6. Sets of impact point from direction A (normal to the board) for the distances A₁, A₂, A₃ and A₆ (Shooter 1)

Fig. 7. Dislocation of the impact point sets from a 2 m distance from spots A₂ through D₂ (Shooter 1)
The dislocation of impact point sets (Shooter 1) relating to the change of angle respective to the board is depicted in Figure 7. We see that the alteration of the angle respective to the board, ranging from full perpendicular to full parallel to the board, causes the sets for individual positions of the shooter to move towards the edge of the backboard and its upper corner. Other experimental shooters shared identical tendencies.

Fig. 8. Sets of impact points from a 2 m distance, spots $A_2$ through $D_2$ (Shooters 1, 2, 3, 4)

As it has been already stated, we have not identified any change in the sets of impact points while shooting from the position perpendicular to the board (A). With shots from the 25° angle (D), we identified varying sets of impact points for individual shooters. The Figure 7 shows an example for the 2m distance. We see no uniform tendency in dislocation respective to the reach of the shooters. The impact zones of individual players have to do with the peculiarities of their shooting.
Proposal for a Didactic Aid to Practice the Bank Shots in Basketball

Our measurements served as groundwork for the proposal of implementing a didactic aid to practice bank shots in basketball (Figure 9 - see next page). The aid consists of a simple set of three guiding spots, which would help the shooter shoot more accurately in training.

The inner circle has a diameter of 0.23m and its center should be positioned 0.3m above the rim. The size and placement of the circle corresponds to the schematic depiction of the most frequent distribution of impact points from shots coming from direction A and distance A₁ through A₆ with all four shooters. This guideline circle is also valid for smaller distances because the shooters subconsciously raise the release angle to be able to shoot above the rim, which also causes a little rise in the impact point on the board. This circle is suitable for guiding the shots which are shot perpendicularly to the board.

The side ellipses serve to practice angled shots. The center point and angle of the ellipse is based on the empiric results from spots C₃ through C₆. The center of the ellipse is positioned 0.36m above the rim and 0.33m from the central vertical axis of the board. The axis of the ellipse has a 60° declination angle from the vertical axis of the board.

The proposed guiding spots help the shooter aim properly while shooting at the board. The spots, however, do not guarantee a perfect hit at all times. Using the trial and error method, they help the shooter find out where to hit the board while shooting from a given spot and angle.

Discussion

The results of our observation serve as a basis to modify the design of a basketball backboard. In any manner appropriate, it will be necessary to place/draw the abovementioned ellipses and the circle, which will serve as appropriate guidelines for the players to practice bank shots. We expect that the application of this type of a modified backboard will improve the success rate of bank shots. It is obvious that the players will also shoot in a way that they miss the ellipse/circle, yet they score a basket. These shots are, however, made as a result of inadequate combination of the release angle and release speed for a given distance and direction, occasionally combined even with non-standard ball spin.
While defining our problem, we discussed the matter with basketball coaches and professionals who all stated that bank shots are not all too frequent in competitions and matches these days. Our counterstatement was that bank shots have their specific place in training, above all in childhood and early stages of acquiring the shooting technique. Furthermore, there are instances when even excellent players have a period of low success rate with clean shots. At those times, it is advisable to recommend the player to implement bank shots, which may be more aggressive and many times suit the players better during the period.

A practical problem is how to portray the ellipses and the circle on the board to avoid breaking the rules during the matches – the rules strictly state what may and must be drawn on the backboard. It is possible to temporarily stick the spots on the board by means of plastic colored sticky papers. The spots may be also drawn permanently either with a marker or paint on the side/training baskets.

The advantage of such a depiction of impact point sets is in its economic viability on a club/school level.
Future research could be more focused on the identification of rebound points depending on the player’s height and ball release height. It will also be necessary to verify our results with a higher number of shots and players involved and to find out whether our impact point sets are, besides adult men, also universally applicable to women and youth.

The author of the experiment fully acknowledges the fact that the proposed didactic aid does not and is not meant to cover all the possible impact and rebound points on the board. Apart from the results gathered in this particular research, the author’s proposal is also based on his personal experience as a basketball coach and predictable practical options at hand.

References:


