STEM education
ORGANIZATION OF EDUCATIONAL ROBOTICS, SCIENCE, TECHNOLOGY & MATHEMATICS

STEMATHLON 2026

BaSTEMball

Description of the game and rules

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A. Brief Description of the Game

BaSTEMball is an exciting team game for primary school students. It is a basketball game where 2 rival alliances, consisting of 2 teams each, try to move their remote-controlled robots as fast as they can and shoot from specific positions on the court (basketball court on a specially designed table). The goal of each alliance is to win the game by scoring more baskets than their opponents as fast as they can.

B. Participants

- **Ages:** (5^{th} – 6^{th} grade class born from 1/1/2014 to 31/12/2015)
- **Persons per group:** 3 players (minimum 2 and maximum 3)
- **Coach:** (from 20 years old and above)

C. Educational Objectives

Educational Robotics is an extremely valuable learning tool, which enhances the acquisition of basic skills that are essential in modern times. Students who undertake to complete various tasks through Educational Robotics develop problem-solving skills, cultivate their creativity, take initiative, experiment with different solutions and generate innovative ideas. One of the main characteristics of Educational Robotics is its ability to combine various fields of knowledge in a unique way, allowing students to integrate and put into practice theoretical knowledge acquired from mathematics, algorithms, programming, engineering and science.

Educational Robotics offers a significant contribution to the educational process, as it combines learning with entertainment through playful learning. At the same time, it promotes collaboration, as students learn to work in teams, and enhances experiential and physical learning.

The BaSTEMball competition, designed based on the principles of Educational Robotics, provides an excellent opportunity to put these pedagogical principles into practice. In particular, its pedagogical value can be summarized in the following points:

It provides a smooth introduction to the world of Educational Robotics, utilizing the popular sport of basketball. The main objective is to form a positive attitude towards Educational Robotics and to demystify it, which is achieved through the use of a simple robot with minimal equipment and programming.

It ensures that the construction and programming is the result of the students' personal work, since the requirements in terms of construction skills and programming knowledge are simple. This allows elementary students to respond without requiring complex connections or algorithms. The requirements of the competition fall within the content of the curriculum.

Preparedness, decision-making and taking initiatives, as skills that a student must cultivate, are present throughout the game - and not only during the preparation before the match -, sharpening the perception of the participants, keeping the interest undiminished and creating a pleasant atmosphere of action, full of surprises and excitement.
The competition offers the opportunity to create a climate of cooperation and teamwork through communication between teams, which is nowadays a key component of creativity and promotes a spirit of fair play.

D. General Principles of the Game

In line with the educational objectives, the following general principles should be mandatory:

1. The robots should be built and programmed exclusively by the students.
2. As in real basketball, the referees' decisions are final. The result of a game cannot be changed unless there has been a mistake in the scorekeeping. Students and their coaches should work together in such a way that the educational objectives of the game are not compromised. Both should also assist in the smooth running of the games.
3. What matters most is not winning or losing, but the participation itself and the excitement of a basketball game.
4. The Organising Committee has the right, at its discretion, to exclude a team from the competition if it finds that it attempts to use unfair means contrary to the spirit of healthy competition on equal terms not expressly provided for in these rules.
5. The rules of the game may be modified by decision of the class officials and the organizing committee before the start of the tournament and communicated to the players, in order to maintain the pedagogical spirit and the smooth running of the games. They also have the right to instruct the judges to intervene on the court or the baskets in case of damage or movement.

E. BaSTEMball Game Rules

1. Students Team

1.1. Each team of students taking part in the competition must build and program a **single** robot.

1.2. Replacement of a robot for any reason is prohibited. Teams that replace any of their robots during the matches will be eliminated from the tournament.

1.3. Each team may consist of only 2 or 3 students and a coach. Students must share roles to ensure that everyone is involved during the game

2. Team Alliances

2.1. An alliance consists of 2 teams of students

2.2. In each match 2 rival alliances collide.

2.3. Before each match, the alliances will be given time to discuss and determine their in-game strategy.

3. Scoring

3.1. A score is achieved when the ball passes the entire rim of the basket the team is attacking.

3.2. For the basket to count, the ball must not hit the court, even if it ends up inside the rim.

3.3. There is no self-basket in case an alliance scores on the other basket.

3.4. The alliance that scores the most points wins the game.

3.5. Each robot must necessarily shoot from specific positions on its own side of the court. (see below the requirements).

3.6. Depending on the position, baskets count for 3, 2, and 1 point, as in regular basketball.

3.7. The seventh shot must be taken from the three-point line behind the free throws.

3.8. The “fire shot” is made from the 3-point line behind the free throws and counts for 5 points.

4. Game Duration

4.1. The game has a total duration of 4 minutes.

4.2. There is no half-time. The teams keep the same space of movement.

4.3. During the race, time runs continuously, without stopping the clock.

4.4. The game is stopped at the end of time or when both alliances have completed their respective shots.

4.5. When teams are not competing, they can repair and reprogram their robots.

5. Game Action

5.1. At the start of the match, approximately 8 balls are placed in the area in the center of the pitch. All robots should be placed in the center squares (Figure 1), on the side where their alliance robot is located, and set up.

Figure 1 Game starting positions

5.2. The match starts at the referee's command.

5.3. At the start each player takes a ball and loads it into his robot. The robots must then head to the first line located at the free throw line (figure 2). Each player immobilizes his robot so that the front projection is either further back or at most touches, but does not exceed, the black line parallel to the free-throw line. The robot's eyes protruding from the front shall not be counted in the robot's projection. The referee, once satisfied of the correct positioning, shall give permission for the shot by raising his hand and pointing with his fingers to number 1

Figure 2 Position for shooting

5.4. If the ball goes into the basket, the point is counted. The ball is removed from the court and placed in the centre. In the event that the ball does not touch any part of the board or the hoop during the shot, then, with the agreement of the referee, it is placed back in the centre so that the robot can pick it up again, going back to its starting point to repeat the same shot.

5.5. Once the procedure from the shooting position is completed, each robot returns to its starting point to pick up another ball and try again from the two-point position (figure 3). The robot must be at least a little inside the square and stationary to load the ball. Each robot must shoot the remaining shots from its chosen side. Mandatorily, if one robot in the alliance shoots from the right side, the other will shoot from the left side. Again, the referee gives permission to shoot with his hand

pointing to 2 after the robot has stopped with its front projection either further back or at most touching the line to the side of the basketball court. Rule 5.4 applies here as well.

Figure 3 Position for a two-point shot

5.6. Once the two-point position is completed, each robot returns to its starting point to load another ball and try again from the three-point position, each from a different angle (figure 4). Again, the referee gives permission to shoot with his hand pointing to 3, after the robot has come to a standstill with its front projection either further back or at most touching the line to the side of the basketball court, behind the white three-point line. Rule 5.4 applies here as well.

Figure 4 Position for a corner three and a top three for the 7th shot

5.7. Once all attempts from the six total positions have been completed, each alliance decides which robot will take the extra ball that will shoot the 7th shot from the three-point line behind the free throws (figure 4). Only the robot of the alliance that has completed the three-shot process is eligible for this attempt. This means that the team that finishes first can execute the shot to save time or simply wait for their teammates to finish and execute it themselves. The procedure applies with the

robot's positioning either being further back or at most touching the line facing the basketball court. Rule 5.4 applies here as well.

5.8. The alliance that finishes all 7 attempts has to place both of its robots in the starting boxes. Then the referees confirm that the alliance has completed its attempts first and give it the right to continue the procedure for the fire shot. The alliance decides which of its robots will shoot the fire shot from the three-point box behind the shots. The robot must again either be further back or at most touch the three-point line. The rule 5.4 applies here as well.

5.9. The "Fire shot" procedure is included in the game time.

5.10. When time expires, the game stops and no further action is allowed.

5.11. If at the end of time a robot takes a shot, it will be considered on time if the referee judges that the ball had left the robot and was heading towards the basket.

5.12. Players are not allowed to touch their robots during the match, except with permission from the referee. If any robots get stuck together, then the referee may separate them by moving them as little as possible.

5.13. It is forbidden for a robot to obstruct an opponent or to cross the center line and enter the opponents' territory. If this happens, an infraction is charged and **the alliance team is penalized with a -5 penalty.**

5.14. The robots can freely touch or cross the lateral end lines during their movement and alignment in order to shoot.

5.15. If players do not follow the shot sequence or shoot from another position, they do not get points, even if they score. The balls are placed back in the center of the court and the robots start the process from where they stopped.

6. Destroyed Robots

6.1. A robot will be declared **“damaged”** by the referee when:

- a part of the robot has been disassembled,
- it remains stationary (communication with the controller is lost)
- if the alliance wants to take one of the its own robots out of the match for any reason.

6.2. A "damaged" robot remains off the field of play until the repair is completed by the students. Immediately afterwards and after permission is given by the referee, it returns to the game. The robot returning to the match is placed at the starting line and resumes shooting from where it was left.

6.3. If a robot rolls over for any reason, with the help of the referee it gets up again and continues the game.

6.4. If both robots from an alliance are declared "destroyed" and are eliminated from the game, the match proceeds as normal. The timer is stopped when all four robots are destroyed and restarted when even one robot comes back onto the field.

6.5. If during the process of resetting the robots one of them is damaged due to the referee untangling them, then the timer stops and the team is given time to repair the robot. In this case, no robot is moved until the damaged robot is also returned to its original position. The timer starts again and the race continues as normal.

7. Specifications of the Robots

7.1. Teams will be required to use an **ELECFREAKS TPBot** car kit robot, an **ELECFREAKS 360 Degrees Building Blocks Servo motor** and up to 2 **microbit**.

7.2. The robots will not be autonomous, but will be controlled remotely. Motion and shot control shall be accomplished by one or a combination of the following means
A) with the laptop **keyboard** and microbit connection software (e.g. **scratch/Mind+**).
B) with a second **microbit board** in cooperation with a fully programmable **remote control** (e.g. ELECFREAKS micro:bit Joystick:bit). The microbit is connected to the controller and then connected to the robot's microbit via software (e.g. makecode).

7.3. Only materials included in the LEGO packs or equivalent building material packs may be used to build the robots.

7.4. Each robot must be equipped with one shooting mechanism, that is, a structure that will perform shots only toward the front, providing thrust to the ball in order to score a basket.

7.5. **In each team, each participating player must make at least one movement with the robot, pick up the ball and take at least one shot.**

7.6. Modification or alteration of the pieces is prohibited.

7.7. For the assembly of robots, the use of other materials, such as glues, tapes, screws, etc.

7.8. It is possible to make pre-programmed movements in the program with the microbit. Attention must be paid to the communication frequencies of the microbit, so that they do not coincide with those of the other robots and interference is caused.

7.9. Each robot must have dimensions not exceeding **14 cm in length**, **14 cm in width** and **27 cm in height**.

7.10. The measurement of the dimensions of the robots shall be made when the robots are in an upright position with all moving parts fully open towards the front of the robot. Attention shall be paid to the shooter mechanism, which shall not exceed the dimensions when opened forward.

7.11. Motor cables are not be included in the measurement of dimensions.

8. Assembly of the Robots

8.1. Players must bring their robots ready on the day of the competition.

8.2. Competing students should not use any kind of assistance, such as instructions or drawings on paper, photos stored on the computer, etc.

8.3. Competing students are allowed to use previously written programs (before the day of the competition).

8.4. Students are allowed to modify their constructions or programs from the time they enter the competition area or in the gap between the competitions. That is, there will be no quarantine before or during the competitions.

8.5. It is the responsibility of the teams to ensure that their robots meet all specifications and restrictions set out in the rules at all times. If, after a race, a robot is found to be in violation of a rule in terms of construction, then the alliance will be stripped of the points earned in that race.

9. Tournament Procedure

9.1. The tournament will be conducted in two phases: the qualifying and the final.

9.2. The qualifying phase will be held in 4 rounds. In each round of this phase, alliances will be formed by random draws.

9.3. In each game the teams of the winning alliance will share 2 points each.

9.4. In games that end in a tie, the winner is the alliance that scored the “Fire shot”. If this did not happen, the winner is the alliance that made more 3-pointers. If there is a tie there as well, the winner is the alliance that made the most 3-pointers from the corners. If there is a tie there as well, the winner is the fastest alliance, i.e. the one that made a “fire shot”. If the tie continues, they share 1 point each.

9.5. In the qualifying phase, teams are ranked in a single league table.

9.6. In the event of a tie in the table, the following criteria will apply in order of priority:

- Points difference
- Number of points scored
- The winner of the match between them
- More Fire shots that went in
- More Fire shots (total won)
- Draw

9.7. The top 16 teams in the qualifying phase qualify for the final phase.

9.8. Final stage alliances are fixed until the end of the tournament and are as follows: The 1st team is allied with the 16th, the 2nd with the 15th, the 3rd with the 14th and so on.

9.9. The alliances compete in knockout games until the grand finale.

9.10. In case a knockout match ends in a draw, the winner is the alliance that scored the “fire shot”. If this did not happen, the winner is the alliance that made the most three-pointers. If there is a tie there as well, the winner is the alliance that hit the most three-pointers from the corners. If there is a tie there as well, the winner is the

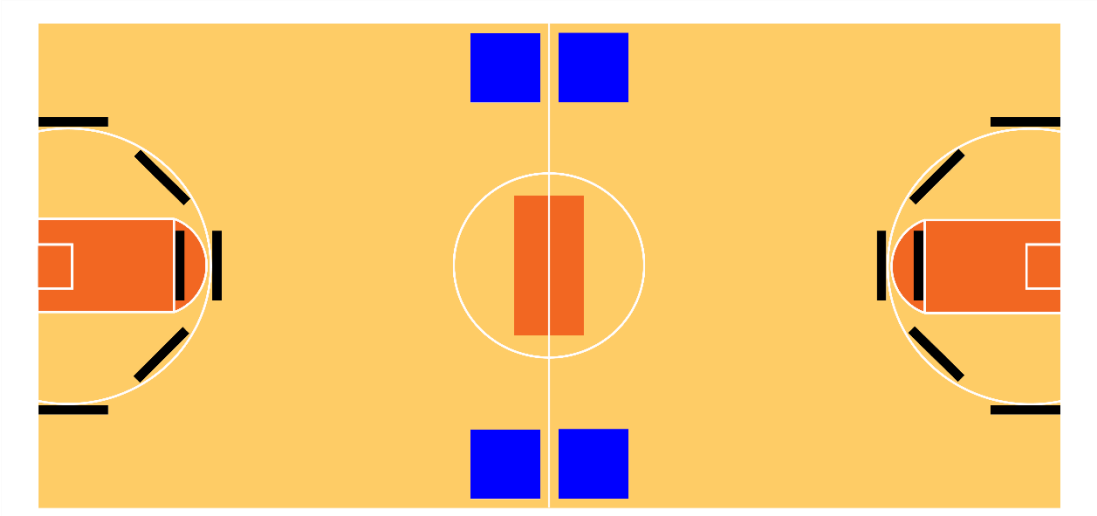
fastest alliance, i.e. the one that made a “fire shot”. If the tie continues, teams take 1 alternating shot from the box at the free throw line. The alliance that scores wins the match at the expense of the alliance that misses.

9.11. The teams of the winning alliance shall jointly share 1st place.

9.12. In case of a team's withdrawal, the game is played as normal with the alliance playing with only one robot, which will shoot all 7 shots. The opposing alliance plays normally with its two teams.

9.13. In the event that both teams in the alliance withdraw, the opposing alliance wins the match with a score of 9-0 in its favour.

10. Basketball court and materials



10.1. The floor will be printed on canvas from a high-resolution file available on STEM Education website.

10.2. The canvas has dimensions: **2362 X 1143 mm**

10.3. The playing field is: **2202 X 1043 mm**

10.4. Distance of the basketball from the three-point stance: **300 mm**

10.5. Distance of the basketball from the two-point stance: **260 mm**

10.6. Distance of the basketball from the shooting position: **220 mm**

10.7. The black lines have the following dimensions: length **150 mm** and thickness **20 mm**

10.8. The blue starting frames have the following dimensions: **150 X 150 mm**

10.9. The frame with the balls in the center (can be made with LEGO blocks, see Annex) has the following dimensions: **300 X 150 mm**

10.10. Ball: red and blue Elecfreaks ball (weight approx. **2.3** - **2,5 gr**)

10.11. The baskets have approximately the following dimensions:

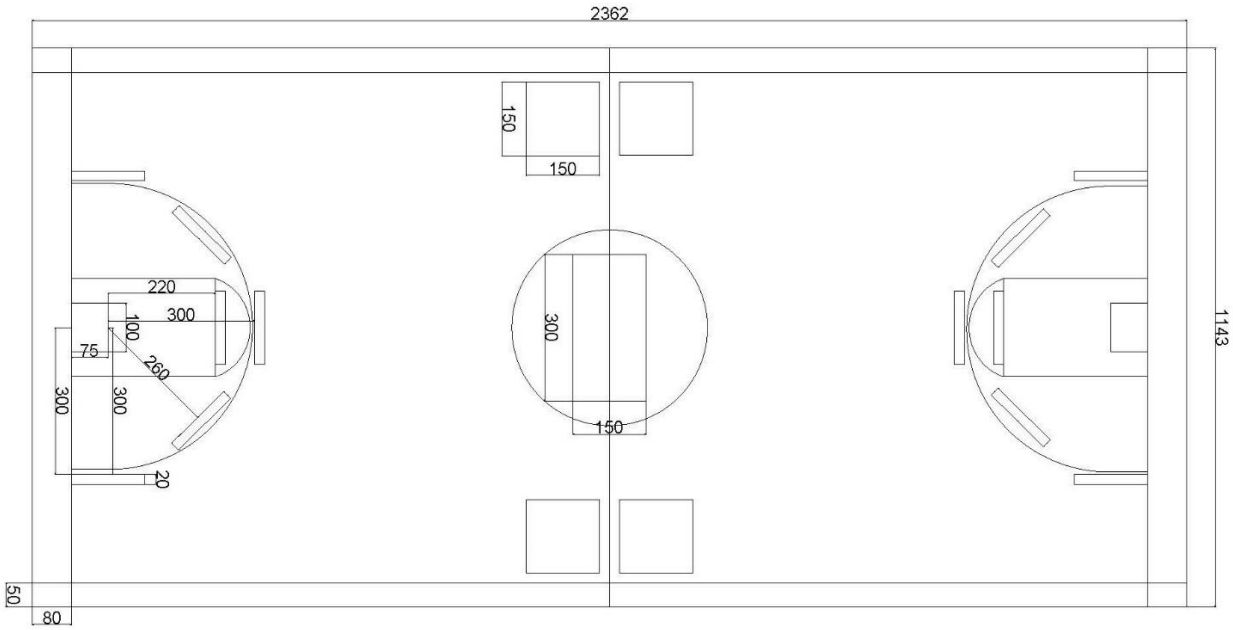
- Height of basketball support with board: **230 mm**

- Height of basketball support with table top: **167 mm**
- Board dimensions: **150 X 80 mm**
- Hoop diameter: **90 mm**
- Hoop height: **150 mm**
- Basket stand: **100 X 75 mm**

F. Annex 1: Rubrica

ALLIANCE A	FREE THROW	2 POINTS	3 POINTS CORNER	3 POINTS FROM TOP	FIRE SHOT won	FIRE SHOT SCORED	PENALTY	TOTAL TEAM	ALLIANCE SCORE
	1	2	3	3	☐	5	-5		
	1	2	3	3	☐	5	-5		
ALLIANCE B									
	1	2	3	3	☐	5	-5		
	1	2	3	3	☐	5	-5		

G. Annex 2: Field plan



H. Annex 3: Indicative Frame Design with the balls

90 blocks 2X4 (e.g. 4 rows of 27+27+18+18)