We greatly appreciate your purchase of our STEM Soccer kit. In your kit, you will find all the items you need to transform your students into critical thinkers.

Another advantage of having any STEM Sports program is that it is designed to have a long shelf-life and is flexible to be applied in classrooms, during after-school programs, and even in camp settings.

STEM Soccer is not the only program we have available. Check out www.STEMSports.com for additional sports such as BMX, volleyball, basketball, football, and multi-sport. Each and every curricula are aligned with Next Generation Science Standards (NGSS) and designed by the most knowledgeable people in education and sport.

We sincerely hope you and your students enjoy this STEM Sports curriculum!
INTRODUCTION

STRUCTURE:
This STEM Soccer manual is designed to deliver content for 16+ hours of instruction for 12 students (6 pairs) as a project based, student-centered, student-led program. The enclosed curriculum is your guide as a teacher/administrator/volunteer to implement the program. How you format that instruction is up to you. In the back of this book are the worksheets for each lesson. The worksheets are to be copied for each student to use and keep as they work their way through each exercise. While each school and learning environment is different, this guide and the proposed structure are for planning purposes only.

DISCLAIMER
This curriculum, including any/all portions of this kit/equipment are intended for educational purposes only. The sport of soccer involves risk of injury, loss and damage. By choosing to partake in this program, all teachers, students, and participants assume full responsibility for such risks. This curriculum makes no representation or warranty, expressed or implied, including but not limited to any warranty of merchantability or fitness for a particular purpose. There are risks associated with participation in any athletic activity, and the student/teacher/participant is responsible for any potential risks associated with these activities. STEM Sports shall not incur any liability for any damages, including but not limited to, direct, indirect, special or consequential damages arising out of, resulting from, or in any way connected to the use of this curriculum, whether or not based upon warranty, contract, or otherwise, whether or not injury was sustained by persons or property, and whether or not loss was sustained from, or rose out of, the implementation of this curriculum. The curriculum contained within this document is the property of STEM Sports, and may not be reproduced or otherwise distributed for use without the written consent of STEM Sports.

See Appendix to reference Next Generation Science Standards and Common Core State Standards connections.
# Soccer Curriculum

## Modules

<table>
<thead>
<tr>
<th>Module</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Science of Throw-Ins</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Calculating Calories and Heart Rate</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Balance and Control with Soccer</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>Soccer Ball versus Futsal Ball</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>Ball Tuning</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>Angles: Shooting Space</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>Goal-Line Technology</td>
<td>13</td>
</tr>
<tr>
<td>8</td>
<td>Probability and Penalty Kicks</td>
<td>15</td>
</tr>
</tbody>
</table>

## Worksheets

<table>
<thead>
<tr>
<th>Module</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Throw-Ins</td>
<td>17</td>
</tr>
<tr>
<td>2</td>
<td>Heart Rate and Calories Burned</td>
<td>19</td>
</tr>
<tr>
<td>4</td>
<td>Properties of Soccer and Futsal Balls</td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>Probability and Penalty Kicks</td>
<td>21</td>
</tr>
</tbody>
</table>

## Additional Info

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplies Checklist</td>
<td>23</td>
</tr>
<tr>
<td>Appendix</td>
<td>24</td>
</tr>
<tr>
<td>Contact Us</td>
<td>31</td>
</tr>
</tbody>
</table>

STEM Soccer Curriculum® STEM Sports, LLC
MODULES
CONCEPT: Throw-ins: Standing vs. kneeling vs. stepping into the throw.

OBJECTIVE: The students will be able to make observations and measurements of an object’s motion to provide evidence that a pattern can be used to predict future motion.

ACTIVITIES
Over the course of any soccer game, there are a handful of different ways that players will throw a dead ball back into play. They can throw a ball from a stand-still position or step into the throw.

Before you begin, discuss among your group which throw-in technique (standing, kneeling, or stepping into the throw) you think will produce the greatest results. Why do you think that?

For this activity, you will pair up with another student. Using the tape and tape measure, tape a line on the surface that is three (3) feet long. This will be your starting point or touchline, as it's referred to in soccer. It is recommended that this activity be performed on grass but not required.

As you go through this activity, make sure that your toes are entirely behind the taped line and that both feet stay planted on the ground as you throw. One partner will throw the ball in, from a stand-still position, and the other partner will measure how far the ball has traveled once it comes to a complete stop. Record the data on the worksheet provided. Repeat the throw-in from a stand-still five times and then switch roles. Then, repeat the throw-in from a kneeling position five times and switch roles. Repeat the activity once more, but this time step into the throw five times and record your data.
# Module 1.0
## Science of Throw-Ins

**CONCEPT:** Throw-ins: Standing vs. kneeling vs. stepping into the throw.

**OBJECTIVE:** The students will be able to make observations and measurements of an object’s motion to provide evidence that a pattern can be used to predict future motion.

**QUESTIONS**

1. Now that you’ve completed the activity, which throwing technique produced the greatest results? Why?
2. What was the average distance of your throws from a stand-still position? From stepping into the throw? (Using the provided disc cone or tape, mark where each throw lands.)
3. What type of throw produced the most bounces?
4. Why do you think that is?
5. How do you think the bounces would change on a grass field?
6. What type of throw produced the least bounces?
7. Why do you think that is?

After those questions are complete, we’re going to use those throw-in techniques and see which best works for accuracy. From the line you taped down, measure and place a cone 10 feet away. Using the different types of throw-ins learned earlier, throw the ball at the cone and see if you can hit it. Record your outcomes on the worksheet.

8. How many cones were you able to knock down (each partner)?
9. Which method was most successful?

**OUTCOME:** Students should be able to construct explanations based on patterns observed of an object’s motion.

**RELATED SKILLSETS:** Throw-ins are an essential skill in soccer. When you throw the ball in, the amount of force in your throw affects how far the ball travels. The key to a good throw is to find the right amount of force and deciding which throwing technique to use.

**STANDARDS:** See appendix on page 24 to reference NGSS and CCSS connections.

### MATERIALS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Soccer balls</td>
<td>Tape</td>
</tr>
<tr>
<td>Tape measures</td>
<td>Disc cones</td>
</tr>
<tr>
<td>Worksheet</td>
<td></td>
</tr>
</tbody>
</table>

**FUN FACTS**

FIFA rules mandate that a ball cannot be thrown directly into the goal; however, an attacking play can be started from a throw-in.

Additional visual resources are available and can be found at: [www.STEMSports.com/resources](http://www.STEMSports.com/resources)
Fill in your measurements:

**Using the tape measure, measure and record the distance of your throws from a stand-still position:**
*Using the provided disc cone or tape, mark where each throw lands.*

Throw 1_______ Throw 2_______ Throw 3_______ Throw 4_______ Throw 5_______

Calculate the average of these five (5) throws: ____________

**Next, measure and record the distance of your throws from a kneeling position:**

Throw 1_______ Throw 2_______ Throw 3_______ Throw 4_______ Throw 5_______

Calculate the average of these five (5) throws: __________________

**Next, measure and record the distance of your throws while stepping into the throw:**

Throw 1_______ Throw 2_______ Throw 3_______ Throw 4_______ Throw 5_______

Calculate the average of these five (5) throws: ____________
MODULE 1.0
WORKSHEET
THROW-INS

Questions:

1. Now that you’ve completed the activity, which throwing technique produced the greatest results? Why?

2. What was the average distance of your throws from a stand-still position? From stepping into the throw? (Using the provided disc cone or tape, mark where each throw lands.)

3. What type of throw produced the most bounces?

4. Why do you think that is?

5. How do you think the bounces would change on a grass field?

6. What type of throw produced the least bounces?

7. Why do you think that is?

Testing for accuracy:

From the line you taped down, measure and place a cone 10 feet away. Using the different types of throw-ins learned earlier, throw the ball at the cone and see if you can knock it down. Each partner will try each different throw-in technique three (3) times each and see if they are able to hit the cone (on a bounce or direct).

Stand-still throw: ___________________ ___________________ ___________________

Kneeling: ___________________ ___________________ ___________________

Stepping into: ___________________ ___________________ ___________________

8. How many cones were you able to knock down (each partner)?

9. Which method was most successful?
ADDITIONAL INFO
### Supplies Checklist

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Six (6) size five (5) soccer balls</td>
<td></td>
</tr>
<tr>
<td>Six (6) regulation-size futsal balls</td>
<td></td>
</tr>
<tr>
<td>Six (6) 25’ tape measures</td>
<td></td>
</tr>
<tr>
<td>Twenty-four (24) disc cones</td>
<td></td>
</tr>
<tr>
<td>Five (5) heart rate monitors</td>
<td></td>
</tr>
<tr>
<td>Six (6) digital timers</td>
<td></td>
</tr>
<tr>
<td>Six (6) training pinnies/jerseys</td>
<td></td>
</tr>
<tr>
<td>Two (2) bells</td>
<td></td>
</tr>
<tr>
<td>Four (4) tent pegs</td>
<td></td>
</tr>
<tr>
<td>One (1) ball of string</td>
<td></td>
</tr>
<tr>
<td>One (1) masking tape roll</td>
<td></td>
</tr>
<tr>
<td>One (1) ball pump</td>
<td></td>
</tr>
<tr>
<td>One (1) set of inflation needles</td>
<td></td>
</tr>
<tr>
<td>Two (2) ball bags</td>
<td></td>
</tr>
<tr>
<td>One (1) STEM Soccer© manual</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX

STANDARDS

SCIENCE OF THROW-INS - MODULE 1.0:

Next Generation Science Standards

5-PS1-3. Make observations and measurements to identify materials based on their properties.

3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

3-PS2-2. Make observations and/or measurements of an object’s motion to provide evidence that a pattern can be used to predict future motion.

3-PS3-2. Ask questions to determine cause and effect relationships between two objects not in contact with each other.

3-PS2-4. Define a simple design problem that can be solved by applying scientific ideas.

3-5.ETS1-1. Define a simple problem reflecting a need or a want that includes specific criteria for success and constraints on materials, time, or cost.

3-5.ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5.ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

5.PS1-3. Make observations and measurements to identify materials based on their properties.

5.PS1-1. Develop a model to describe that matter is made of particles too small to be seen.

4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.

5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.

Common Core State Standards Connection

CCSS.ELA-LITERACY.CCRA.SL.4

Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
APPENDIX

CCSS.ELA-LITERACY.SL.5.1.C
Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.

CCSS.MATH.CONTENT.4.OA.A.3
Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

CCSS.ELA-LITERACY.SL.4.1
Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others’ ideas and expressing their own clearly.

CCSS.ELA-LITERACY.SL.4.1.B
Follow agreed-upon rules for discussions and carry out assigned roles.

CCSS.ELA-LITERACY.SL.4.1.C
Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.

CCSS.ELA-LITERACY.L.4.1.A
Use relative pronouns (who, whose, whom, which, that) and relative adverbs (where, when, why).

CCSS.ELA-LITERACY.L.4.1.B
Form and use the progressive (e.g., I was walking; I am walking; I will be walking) verb tenses.
STEM Sports is dedicated to combining scientific learning and sports to help students develop critical-thinking skills that may be applied throughout the rest of their lives. Our team is committed to the educational enrichment of today’s youth. These programs are written by the most knowledgeable people in education and sport. The kit and curriculum are designed to have a long shelf-life and are flexible to be administered in classrooms, during after-school programs, and camps. The curriculum is also scalable and provides expandability for elementary, middle, and even high school grade levels.

For general inquiries or questions regarding the program, please contact:

Info@STEMSports.com
602.845.0316
www.STEMSports.com