Anatomy of a Throw

1. Have the demonstrator lead everyone in a general warm up.
2. Split the students into two groups (male and female), and have them investigate what makes a good throw i.e. throw with just wrist, no trunk etc.
3. Have each group select their “best” thrower as a volunteer.
4. Explain that we will be investigating how much a run-up contributes to a throw. The demonstrator will show students what is meant by this.
5. We will calculate how fast a throw is with everything. The next condition will use everything EXCEPT a run-up. ASK students to PREDICT: Will this throw be faster or slower or the same as the first condition?
6. Ask students to predict what percentage this contributes, and record in Table 2.
7. So now if we are able to calculate the velocity of this condition and subtract it from the first condition then we will know how much a run-up contributes to a throw.
8. The demonstrator will use of the camera and the computer with the grid.
9. Explain that speed on measures one direction, but when we throw a ball there is movement in both the horizontal (forward) direction as well as the vertical (up and down) directions. This is important for when we do the final calculations later.
10. Enter the data for distance travelled for each throw into columns for x and y in Table 1. Also enter the time taken for this throw.
11. Once the students have carried out all of their conditions, they move on to do the velocity calculations.
12. Explain that the speeds only apply to either vertical or horizontal directions. To find the overall speed, we have to combine both directions. So we call this VELOCITY. We need to find the speed in two directions, x and y, and then combine these values into a velocity. The equation to do this is:

$$v^2 = v_x^2 + v_y^2$$

13. Use the formula to work out the value of velocity, v, for each throw. Students do steps 7-8.
14. Explain that we will use these velocities to find out the amount that the run-up contributes to an "everything" throw.
15. Explain that the Derived Velocity is the "everything" velocity minus the standing still velocity. By subtracting the velocity at each testing condition we can find out what proportion or part of the throw is due to the run-up.
16. Now we can convert the segment contribution into a percentage. If we say that the "everything" throw is 100%, then the Derived Velocity is some part of that 100%. The equation to use makes a proportion or ratio of the Segment velocity to Everything velocity and multiplies that by 100 to get a %.

$$\frac{DV}{V_0} \times 100$$

17. Ask students to compare the % values with the other group. Which groups volunteer improved the most?
18. In extra time, students can try other conditions e.g. left handed throwing; kicking;

Optional Activity

If there is extra time to fill can try the muscle model activity in Appendix A.

<u>Materials</u>

- 50 x 5mm rubber bands
- 10 x rubber bands, a range of thicknesses
- 10 x 30cm rulers
- 10 x handouts