The Laboratory

Basketball Analysis Lab

Teacher's Guide

Topic:

Vectors and Projectiles

The following information is provided to the student:

> **Question:**
> How can the changes (or lack of changes) in the motion quantities (position, velocity and acceleration) of a projectile be described over the course of time?
>
> **Purpose:**
> To describe how the motion quantities (position, velocity and acceleration) of a projectile change (or don't change) over the course of time.
>
> A complete lab write-up includes a Title, a Purpose, a Data section, and a Conclusion/Discussion. The Data section includes plots of the d_x and d_y values with respect to time, plots of the v_x and v_y values with respect to time and plots of the a_x and a_y values with respect to time. All plots should be clearly labeled. Slope values for the two velocity graphs should be shown and labeled beside each graph. The Conclusion/Discussion should use words to thoroughly respond to the question raised in the Purpose. For each conclusion statement, at least one piece of supporting evidence should be provided; six sentences would be the minimum amount of writing.

Materials Required:

Computer; Logger Pro software from [Vernier Software](#) with accompanying Basketball Shot file.

Description of Procedure:

A short video segment of the motion of a projectile is analyzed using a frame-by-frame video analysis technique. The actual procedure for the video analysis is complicated and warrants a separate page of directions (view as [MS Word file](#); view as [PDF](#)). The outcome of the procedure is that position-time graphs, velocity-time graphs, linear regression statistics, and a vector diagram are constructed as representations of the basketball's motion through the air.

Alternative Materials and Procedure:

Students could collect video footage (short, 2-3 second duration) of the motion of a projectile and conduct a similar analysis. Other software is available, most notably is the Tracker software available as part of the [Open Source Physics project](#) operated by [Compadre](#).

Safety Concern:

There is always a higher than usual level of risk associated with working in a science lab. Teachers should be aware of this and take the necessary precautions to insure that the working environment is as safe as possible. Student *horseplay* and off-task behaviors should not be tolerated.

Suggestions, Precautions, Notes:

The Laboratory

1. The frame-by-frame video analysis capabilities of Vernier's software program is an outstanding, easy-to-use add on to the computer interface software program. Several videos are included with the program. Additional videos for download and analysis are available online from a variety of web sites.
2. This lab involves a complicated procedure. Strict adherence to the provided directions will lead a student to a successful collection of data and graphs. Much more than an animation lab, this lab involves a detailed analysis of an actual object via a video recording.

Auxiliary Materials:

None

Scoring Rubric:

VP6.	Basketball Analysis Lab	Score
____	Included, labeled and organized all parts of the lab report.	
____	Data section includes appropriate graphs (d_x and d_y, v_x and v_y, and a_x and a_y with respect to time); axes are labeled; plots are reasonably accurate. Slopes for the two velocity graphs are reported and labeled (along with the unit).	____/____
____	Conclusion/Discussion describes how the six quantities (d_x and d_y, v_x and v_y, and a_x and a_y) change (or don't change) with respect to time; at least one piece of supporting evidence is provided for each statement. Discussion is thorough and accurate.	

Connections to The Physics Classroom Tutorial:

The following readings are a suitable accompaniment to this lab:

http://www.physicsclassroom.com/Class/vectors/u3l2a.cfm

http://www.physicsclassroom.com/Class/vectors/u3l2b.cfm

http://www.physicsclassroom.com/Class/vectors/u3l2c.cfm

http://www.physicsclassroom.com/Class/vectors/u3l2c2.cfm

Connections to Minds on Physics Internet Modules:

Sublevels 7 and 8 of the Vectors and Projectiles module are a suitable accompaniment to this lab:

http://www.physicsclassroom.com/mop/module.cfm