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Video Physics combined with F1 in schools

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Short Description:

The Video Physics eTool will be used for measuring the velocity of F1 in Schools cars. Students can take or use a [video of an F1inSchools car in motion^{\(1\)}](#), mark its position frame by frame, and set up the scale using a known distance. Video Physics will display the path of the moving object (F1inSchools car) and provide graphs of Y vs X as well as the X and Y position and velocity as a function of time. Students can measure the velocity of the F1 inSchool car, perform on-the-go analysis of the motion, and share video, graphs and data to Facebook, to their photo library and or to their computer.



Aims:

- Combination / integration of existing science tools and applications using technologies of different devices.
- Introduces the use of mobile devices (smartphones and tablets) in physics education.
- Improves motivation – The engaging nature of the F1 in Schools activities and the glamorous topic makes students want to learn.
- Raise achievement – It enables students to take responsibility for ‘**creating something**’ themselves and make students enthusiastic about achievements that are truly their own.

Fostered Skills:

It challenges students to use their mobile devices to learn about science and physics.
It challenges students to learn through engagement in a series of real problems that students are likely to face as future professionals.

Connection to the curriculum:

Video Physics for measuring the velocity of F1 in Schools cars is intended for use in physics education. The video analysis done in Video Physics is a useful technique for studying one and two-dimensional kinematics.

Implementation of the Demonstrator:

1st learning activity (Orienting & Asking questions).

This activity sets out what students have to do with Video Physics:

Frequently Asked Questions:

What is Video Physics?
What is video analysis?
How do I get started with Video Physics?
How do I mark points?
How do I fix a point marker?
How do I delete a marked point?
I can't see how to play a video.
Can I zoom in to mark points?
How do I rename a Video Physics project?
How do I delete a Video Physics project?

2nd learning activity (Hypothesis & Design - Orienting & Asking questions)

The activity focusing upon not only what students are required to do, but also what will help them to do well.

Frequently Asked Questions:

What kind of things can be used to scale the video?
What kind of videos can be analyzed?
How do I share videos?
How many objects will Video Physics track?
How do I avoid blurred images in videos?
Any other hints for good videos?
Will Video Physics do curve fits?
What about the other sample videos?
Do you have any ideas for other cool videos to collect?

3rd learning activity (Planning & Investigation)

The teacher can use the [Physics with Video Analysis Book^{\(4\)}](#) to support hypotheses that the students should investigate. This book contains a wide selection of video analysis activities for introductory physics at either the high school or college level.

4 Free Samples Activities can be downloaded from this [link^{\(4\)}](#) .

4th learning activity (Analysis & Interpretation)

Students can make use of complete experiments with materials list, step-by-step instructions, data tables, and questions.

Teacher can use the Information section for each experiment with complete directions for setting up

experiments, helpful hints, and sample graphs and data.

The [Physics with Video Analysis Book^{\(4\)}](#) includes also professionally-made digital videos and word-processing files of the student sections on a CD so that any experiment may be easily edited to their specifications (Microsoft Word for Macintosh and Windows files).

5th learning activity (Conclusion & Evaluation)

From the [Physics with Video Analysis Book^{\(4\)}](#) teachers can select one of the experiments below to view objectives and standard correlations.

4 Free Samples Activities can be downloaded from this [link^{\(4\)}](#) .

- 1 [Rolling Ball](#)
- 2 [Big and Small: How to Scale an Image](#)
- 3 [Velocity Change](#)
- 4 [Velocity and Speed](#)
- 5 [Velocity and Acceleration](#)
- 6 [Three Movies: Determining Constant Acceleration](#)
- 7 [Demon Drop: A Mathematical Modeling Activity](#)
- 8 [Jumping on the Moon](#)
- 9 [2D Vectors: Pool Ball Displacement, Velocity, and Speed](#) (Free Sample Activity, click to
- 10 [Galileo's Projectile I: Using 17th Century Techniques](#)
- 11 [Galileo's Projectile II: Using Contemporary Techniques](#)
- 12 [Projectile Motion Vectors](#)
- 13 [Frictional Slowing](#)
- 14 [Impulsive Juggling](#) (Free Sample Activity, [click to download](#))
- 15 [Center of Mass Motions](#)
- 16 [Finding a Spring Constant](#)
- 17 [Net Work - Kinetic Energy Theorem](#)
- 18 [Oscillations](#)
- 19 [Slinky Wave Speeds](#)
- 20 [Superposition of Slinky Waves](#)
- 21 [A Wave Pulse Equation](#)
- 22 [Doppler Effect: Surface Water Waves](#)
- 23 [Doppler Effect: Sound Waves](#) (Free Sample Activity, [click to download](#))
- 24 [A Heat Engine: Relating Work to the P-V Cycle](#)
- 25 [Coulomb's Law for Two Charged Spheres](#)
- 26 [Discharge Rate](#)
- 27 [Electric Field Due to a Line of Charge](#)
- 28 [Resistance and Ohm's Law](#)
- 29 [Parallel Plate Capacitor: Potential Difference vs. Spacing](#)
- 30 [Wiring Capacitors in Series and Parallel](#)
- 31 [Using RC Decay to Determine Capacitance](#) (Free Sample Activity, [click to download](#))
- 32 [Exploring Faraday's Law](#)
- 33 [Snell's Law of Refraction](#)

Domain:	Big Idea of Science:	Age group:	Time needed:
Physics, Technology, Mathematics	3	12-15 15-18	2 hours
Languages available:	Equipment needed	Involved actors	Used eTool and link:
English, Spanish	<ul style="list-style-type: none"> - iOS Mobile Device (iPhone, iPad, iPod touch) - Video Physics App⁽³⁾ - Physics with Video Analysis Book⁽⁴⁾ - F1 in Schools Car 	Students, Parents, Teachers, F1 in Schools Country Coordinators	<p>Video Physics; F1 in Schools, https://itunes.apple.com/us/app/vernier-video-physics/id389784247</p> <p>F1 in Schools Recourses: Germany : http://www.f1inschools.de/ UK : http://www.f1inschools.co.uk/ Ireland : http://www.f1inschools.ie/ Portugal : http://www.f1inschools.com.pt/ Greece & Cyprus: http://www.f1inschools.gr/ Czech Republic : http://www.f1veskolach.cz/ USA : http://f1inschools.sae.org/</p> <p>Australia : http://rea.org.au/f1-inschools/ UAE: http://f1inschools.ae/en/Default.aspx</p> <p>F1 in Schools Teachers Guide⁽²⁾</p> <p>Video highlights for F1 in Schools National and World Finals: http://www.youtube.com/watch?v=3frL41trwB8 http://www.youtube.com/watch?v=7dP3vsj6JH8 http://www.youtube.com/watch?v=jGx4zDnCigY http://www.youtube.com/watch?v=1EaO2Txp1r4 http://www.youtube.com/watch?v=9b6jVHmrWc4 http://www.youtube.com/user/REAFoundation?feature=watch</p>

Quality Characteristics of the Demonstrator

Characteristic I

how Demonstrator follows an **inquiry based approach**

Students acquire scientific inquiry skills and domain-based knowledge through discovering relations between dependent and independent variables. They start from an every-day life problem, analyze the problem situation, and define research questions and hypotheses. Hypotheses are tested through real observations or simulations. Data collection devices and software simulation are used for collecting real or experimental data.

Students collaboratively solve problems and reflect on their experiences. It is an inductive approach in the sense that students learn the content and concepts as they try to address a problem.

Characteristic II

how Demonstrator integrates **eLearning element**

By using their mobile devices to learn about physics, students can interact and work together with engineers in a real-world environment, giving them valuable skills and knowledge they can use to succeed in school and in their later careers.

The teacher can use online [Curriculum Resources^{\(4\)}](#) to support hypotheses that the students should investigate.

Characteristic III

how Demonstrator follows a **Big Idea of Science**

The Video Physics combined with the F1 in Schools challenge inspires students to learn about Newton's laws of motion:

Changing the movement of an object requires a net force to be acting on it.

Characteristic IV

how Demonstrator is connected to a **real world problem**

The Video Physics enables students to take responsibility for 'creating something' by themselves and supports their enthusiasm for achievements that are truly their own.

Here are some examples:

Students can study the motion of any moving object. For example a roller-coaster, or a child's swing, or a basketball free throw shot.

Students can investigate the meaning of average speed and average velocity in a two-dimensional environment.

Students can study ball motion in free fall and during the throws.

Using a video of a car passing a microphone the FFTs of the sound recording, along with video analysis of the car motion, can be used to observe the doppler effect.

Experiences with the Demonstrator?

- Where? In more than 10 countries
- When? Since 2011
- How many learners involved? TBC
- Results available?
[Video Physics App. Customer Reviews^{\(5\)}](#)
http://en.wikipedia.org/wiki/F1_in_Schools
[F1 in Schools Catalogue Review^{\(6\)}](#)

References

- (1): <http://www.youtube.com/watch?v=-GQTNwjCupI>
- (2): http://www.f1inschools.ie/resources/Teachers_Guide_2012_13.pdf
- (3): <https://itunes.apple.com/us/app/vernier-video-physics/id389784247>
- (4): <http://www.vernier.com/products/books/pva/>
- (5): <https://itunes.apple.com/us/app/vernier-video-physics/id389784247>
- (6): <https://docs.google.com/file/d/0B-JIGA25ExZ8SEFMZIF2ZE5COXM/edit?pli=1>

