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Using Physlets in HS Physical Science

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The project proposed involves using physlets as a means of getting students engaged and delivering ideas and concepts in a novel manner. Physlets are Java applets that are designed to address a specific Physics concept. There are many similar applets for other fields such as chemlets which address Chemistry topics. There are many resources regarding physlets and we have chosen to focus on one repository, Physlet Physics by Wolfgang Christian and Mario Belloni. With the funding from the Arthur Vining Davis Jr. Grant, we can purchase a reference text and a copy of a CD with approximately three hundred physlets and problems to go along with the physlets to be used in the classroom. In the example below, a web link is used to demonstrate the concept

In the outline below, I have included Mrs. Springfield's schedule for the class and then the physlets that would pertain to each week. Along with this, I have stated what week and topic is covered, and then underneath put the subject, pages, and activities that are connected to those topics. The pages and activities refer to the Physlet Physics textbook I mentioned above.

An example of using physlets to address a topic is given here:

Using Illustration 2.3 on the following website (if we purchase the book and CD this would be on your classroom computer)

http://webphysics.davidson.edu/physlet_resources/physlet_physics/contents/mechanics/oned_kinematics/default.html

the teacher can illustrate the concepts of average velocity vs. instantaneous velocity. After introducing the topics to the students, the students are shown the physlet animation and asked to answer questions regarding the average velocity and instantaneous velocities.

This physlet provides a visual as to what the term actually means and provides some questions so that the teacher can see if the students comprehend the material. An informal or formal assessment could then be done through discussion or multiple choice questions to measure the students' understanding of the topic. If adapted some, a physlet could be used as a "virtual experiment" and allow for the students to explore and discover topics on their own.

The second style of activity attached in this outline is an "exploration." These are mainly set up as interactive problems or a visual that takes the student into a higher level in Bloom's Taxonomy of thinking. For Exploration 2.3,

http://webphysics.davidson.edu/physlet_resources/physlet_physics/contents/mechanics/oned_kinematics/default.html

the students are asked to apply what they have learned about the instantaneous velocity to a different situation.

In this particular exploration, a graph of velocity vs. time is shown and we are asked to figure out what path the golf ball takes. The students could answer this as a class, in small groups, or you could do it as a quick quiz. In addition to the answers, the students could be asked to justify why they feel their answer is correct.

The two activities mentioned above both address the topic of instantaneous velocity and could be combined to provide the teacher with a visual supplementary source to the lesson. The outline below suggests other topics based on the course outline I was provided with physlet links to illustrations and explorations for each topic. Going along with the topics that would be covered in both the CP and Honors level courses, I went through and picked the ones that I thought might be applicable to the classes. The Physlet Physics book also offers problems at the end of each chapter that could be used as an in-class activity, homework, or test questions. Problem 2.3 is a good example to use with the illustration and exploration we have presented above:

http://webphysics.davidson.edu/physlet_resources/physlet_physics/contents/mechanics/one_d_kinematics/default.html

In summary, the proposal is to use physlets as a supplement to standard lectures for the introduction to physics concepts. Each concept will be assigned an illustration, exploration, and problem set. The vision here is to use the physlets to address specific topics in the Physics portion of a Physical Science or Physics class. I hope that the teacher is able to use these selected physlets as supplementary materials with the lesson plans they already have. The purpose of physlets is to add a visual component that is not always available with a standard lecture. This could also be extended into the Chemistry portion by searching for and adapting chemlets for the chemistry portion.

Mrs. Springfield's Schedule:

Week 11	Chapter 11	Motion	Sections 1-3
Week 12	Chapter 12	Forces	Sections 1-3
Week 13	Chapter 13	Work and Energy	Sections 1, 3, & 4
Week 14	Chapter 14	Heat and Temperature	Sections 1-3
Week 15	Chapter 15	Waves	Sections 1-3
	Chapter 16	Sound and Light	Section 2
Week 16	Chapter 17	Electricity	Sections 1-3
Week 17	Chapter 18	Magnetism	Sections 1-3

Below is an outline of the explorations and illustrations that I have picked out of the physlets book to accompany Mrs. Springfield's lessons. I have placed illustrations and explorations that go hand-in-hand together into one activity that could be used in a day to enhance the lecture.

Week 11: Motion

1-Dimensional Kinematics(pg 7-19)

Activity 1

- Illustration 2.1 (Position and displacement) – pg 7

Activity 2

- Illustration 2.3 (Average velocity vs Instantaneous velocity) – pg 8
- Exploration 2.3 (Graph of velocity to figure out path of golf ball) – pg 12

Activity 3

- Illustration 2.5 (Motion on a hill) – pg 10

Activity 4

- Illustration 2.6 (Free Fall) – pg 11
- Exploration 2.6 (Setting initial velocity to barely hit ceiling) – pg 13

Activity 5

- Exploration 2.7 (Drop two balls; one with a delayed drop) – pg 13

2-Dimensional Kinematics(pg 19-26)

Activity 1

- Illustration 3.4 (Projectile Motion) – pg 21

Activity 2

- Exploration 3.5 (Uphill and Downhill Projectile Motion) – pg 24

Week 12: Forces

Newton's Laws(pg 30-46)

Activity 1

- Exploration 4.1 (Vectors for a Box on an Incline) – pg 33

Activity 2

- Illustration 4.2 (Free-Body Diagram) – pg 29

Activity 3

- Illustration 4.3 (Newton's Second Law and Force) – pg 30

Activity 4

- Illustration 4.4 (Mass on an Incline) – pg 31

Activity 5

- Exploration 4.7 (Atwood Machine) – pg 35

Activity 6

- Exploration 5.3 (Spring Force) – pg 42

Activity 7

- Illustration 5.4 (Springs and Hooke's Law) – pg 40

Week 13: Work and Energy

Work(pg 47-56)

Activity 1

- Illustration 6.2 (Constant Forces) – pg 47

Activity 2

- Illustration 7.2 (Representations of Energy) – pg 57

Activity 3

- Illustration 7.3 (Potential Energy Diagrams) – pg 58
- Exploration 7.3 (Elastic Collision) – pg 61

Week 14: Heat and Temperature

Heat and Temperature(pg163-168)

Activity 1

- Illustration 19.1 (Specific Heat) – pg 163

Activity 2

- Illustration 19.3 (Heat Transfer, Radiation) – pg 164
- Exploration 19.3 (Calorimetry) – pg 165

Week 15: Waves

Waves(pg 145-153)

Activity 1

- Illustration 17.1 (Wave Types) – pg 145
- Exploration 17.1 (Superposition of Two Pulses) – pg 148

Activity 2

- Illustration 17.3 (Superposition of Pulses) – pg 146

Activity 3

- Exploration 17.5 (Superposition of Two Waves) – pg 149

Week 16: Sound and Light

Sound(pg 155-162)

Activity 1

- Illustration 18.1 (Representation of Two-Dimensional Waves) – pg 155

Activity 2

- Illustration 18.2 (Molecular View of a Sound Wave) – pg 155

Activity 3

- Illustration 18.3 (Interference in Time and Beats) – pg 155

Activity 4

- Illustration 18.4 (The Doppler Effect) – pg 156
- Exploration 18.4 (Doppler Effect and the Velocity of the Source) – pg 159

Week 17: Electricity

Electricity(pg 197-203, 253-263)

Activity 1

- Exploration 23.1 (Fields and Test Charges) – pg200

Activity 2

- Illustration 23.2 (Electric Fields from Point Charges) – pg 197
- Exploration 23.2 (Field Lines and Trajectories) – pg 201

Activity 3

- Illustration 23.3 (Field-Line Representation of Vector Fields) – pg 198

Activity 4

- Illustration 23.4 (Practical Uses of Charges and Electric Fields) – pg 199

Activity 5

- Illustration 30.1 (Complete Circuits) – pg 253

Activity 6

- Illustration 30.3 (Current and Voltage Dividers) – pg 253

Activity 7

- Illustration 30.6 (RC Circuit) – pg 255

Activity 8

- Illustration 30.7 (The Loop Rule) – pg 255

Week 18: Magnetism

Magnetism(pg 229-235)

Activity 1

- Illustration 27.1 (Magnets and Compass Needles) – pg 229

Activity 2

- Illustration 27.2 (Earth's Magnetic Field) – pg 230
- Exploration 27.2 (Velocity Selector) –pg 232

Activity 3

- Illustration 27.3 (A Mass Spectrometer) – pg 230
- Exploration 27.3 (Mass Spectrometer) – pg 233