New York State Physical Setting: Physics

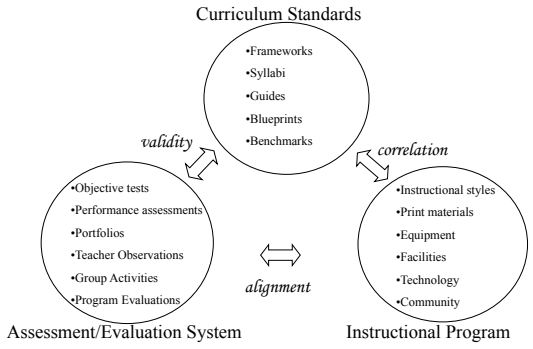
A Review of the June 2007 Exam
WNYPTA, Buffalo, NY
May 17, 2008

J. Zawicki, Earth Sciences and Science Education
K. Falconer, Elementary Education and Reading
SUNY Buffalo State College

T. Johnson, Erie 1 BOCES, WNYRIC

Assessment Purposes

- Teachers
  - Measure knowledge
  - Measure gain in knowledge
  - Sorting (Grading)
- Students/Parents
  - Measure preparation (predict success)
- School District/State Education Department
  - Degree requirements (benchmarks)
- Others…



Types of Analysis

- Traditional
  - Difficulty (Facility)
  - Discrimination
  - Response pattern
- Item format
- Difficulties analyzed in the context of issues:[1]
  - Student
  - Instructional (Teacher, School)
  - Testing

[1]NYS Biology Mentor Network

Use of Assessment Data

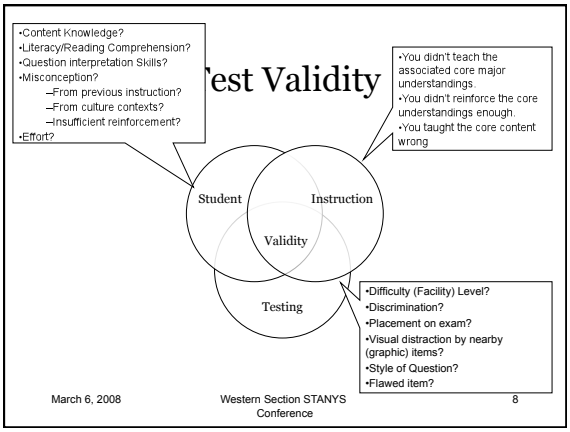
- Formative techniques
  - Whiteboards
  - Exit slips
  - Homework assignments
  - Teacher quizzes
- Program review - Summative
  - Statewide and regional exam summaries
  - Mid-term and final exam data

Assessment Concepts

- Difficulty – Percentage or proportion that are successful on an item
- Discrimination – How well does an item differentiate between students who understand the subject and those who do not?
- Validity – Does an item measure student understanding of the intended concept?

Concepts (Continued)

- Reliability – can the results be replicated?
  - Inter-rater
  - Test/Re-test
  - Internal Consistency
- Criterion referenced tests



Test Data – Discussion and Analysis

- Collecting Data
- Analysis
  - Difficulty
  - Response Pattern

Multiple Choice Data

Item	*Key Idea*	*Major Understanding*
43	4. 4.1-Trans. of Energy	4.1c Potential energy is the energy an object possesses by virtue of its position or condition. . .
11	4. 4.1-Trans. of Energy	4.1d Kinetic energy is the energy an object possesses by virtue of its motion.
12	4. 4.1-Trans. of Energy	4.1e In an ideal mechanical system, the sum of the macroscopic kinetic and potential energies. . .
44	4. 4.1-Trans. of Energy	4.1i Power is the time-rate at which work is done or energy is expended.

Item	*Difficulty*	*1*	*2*	*3*	*4*	*NR*
43	0.68	130	364	443	***2163***	73
11	0.88	142	60	105	***2797***	69
12	0.65	259	501	***2056***	346	11
44	0.77	***2450***	222	292	137	72

Constructed Response Data

Item	*Difficulty*	*0*	*1*	*2*	*NR*
56-CR	0.97	99	3074	0	0
49-CR	0.97	109	3064	0	0
50-CR	0.96	125	3048	0	0
55-CR	0.96	138	3035	0	0
51-CR	0.87	416	2757	0	0

Claim #1 - Equivalent Resistance

Students do not have a conceptual understanding of energy dissipation within a circuit.

Equivalent Resistance

20 A 4.50-volt personal stereo uses 1950 joules of electrical energy in one hour. What is the electrical resistance of the personal stereo?

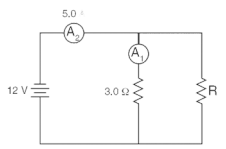
(1) 433 Ω (3) 37.4 Ω

(2) 96.3 Ω (4) 0.623 Ω

Item	Difficulty	1	2	3	4	NR
3	0.54	493	265	***1707***	636	72

Equivalent Resistance (Con't)

A 3.0-ohm resistor, an unknown resistor, R, and two ammeters, A_1 and A_2, are connected as shown with a 12-volt source. Ammeter A_2 reads a current of 5.0 amperes.



58. Determine the equivalent resistance of the circuit. [1]
D = 0.49

59. Calculate the current measured by Ammeter A_1. (Show all work) [2]
D=0.80

60. Calculate the resistance of unknown resistor, R. (Show all work) [2]
D=0.61

Claim #2 - Newton's Third Law

Students do not "see" action/reaction pairs.

Modified Benjamin Bloom:

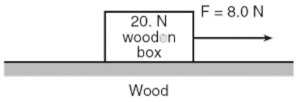
knowing

using

integrating

Newton's Third Law

A horizontal force of 8.0 newtons is used to pull a 20.-newton wooden box moving toward the right along a horizontal, wood surface, as shown.



61 Starting at point *P* on the diagram *in your answer booklet*, use a metric ruler and a scale of 1.0 cm = 4.0 N to draw a vector representing the normal force acting on the box. Label the vector *FN*. [1] *D = 0.49*

62 Calculate the magnitude of the frictional force acting on the box. [Show all work, including the equation and substitution with units.] [2] *D = 0.72*

63 Determine the magnitude of the net force acting on the box. [1] *D = 0.47*

64 Determine the mass of the box. [1]

Newton's Third Law

10 Earth's mass is approximately 81 times the mass of the Moon. If Earth exerts a gravitational force of magnitude *F* on the Moon, the magnitude of the gravitational force of the Moon on Earth is:

(1) *F* (3) *9F*

(2) *F/81* (4) *81F*

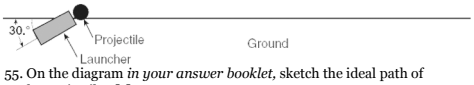
Item	Difficulty	1	2	3	4	NR
3	0.34	***1072***	1718	66	317	0

Claim #3 - 2-D Motion

Student find it difficult to recognize the independence of the vertical and horizontal motions.

2-Dimensional Motion

A projectile is launched into the air with an initial speed of v_i at a launch angle of 30° above the horizontal. The projectile lands on the ground 2.0 seconds later.



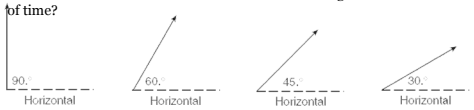
55. On the diagram *in your answer booklet,* sketch the ideal path of the projectile. [1] D = 0.96

56. How does the maximum altitude of the projectile change as the launch angle is increased from 30.° to 45.°? [1] D = 0.97

57. How does the total horizontal distance traveled by the projectile change as the launch angle is increased from 30.° to 45.° above the horizontal? [Assume the same initial speed, v_i.] [1] D = 0.49

June 2006 - Similar Case

A volleyball hit into the air has an initial speed of 10. meters per second. Which vector best represents the angle above the horizontal that the ball should be hit to remain in the air for the greatest amount of time?



Item	Difficulty	1	2	3	4	NR
44	0.32	***649***	151	902	302	4

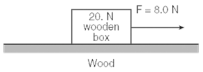
Claim #4 Mass/Weight

A 2.00 kilogram object weighs 19.6-newtons on Earth. If the acceleration due to gravity on Mars is 3.71 meters per second^2, what is the object's mass on Mars?

Item	Difficulty	1	2	3	4	NR
3	0.38	153	***1220***	129	1597	74

Mass/Weight

A horizontal force of 8.0 newtons is used to pull a 20.-newton wooden box moving toward the right along a horizontal, wood surface, as shown.



61. Starting at point P on the diagram in your answer booklet, use a metric ruler and a scale of 1.0 cm = 4.0 N to draw a vector representing the normal force acting on the box. Label the vector F_N. [1] *D = 0.49*
62. Calculate the magnitude of the fricitional force acting on the box. (Show all work.) [2] *D = 0.72*
63. Determine the magnitude of the net force acting on the box. [1] *D = 0. 47*
64. Determine the mass of the box. [1] *D = 0.76*
65. Calculate the magnitude of the acceleration of the box. [Show all work.] [2] *D = 0.80*

Conclusions

- Current results parallel data from previous years - difficult topics remain challenging
- Individual results are the most effective tools for program review
- Additional information:

  J. Zawicki zawickjl@buffalostate.edu